ELECTRICAL WORLD
AND
Electrical Engineer.

ELECTRICAL WORLD, Vol. 33, No. 23. NEW YORK, JUNE 10, 1899. ELECTRICAL ENGINEER, Vol. 27, No. 579.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(Incorporated).

120 LIBERTY STREET, NEW YORK.

Telephone Call: 4044 Cortlandt. Cable Address: Electrical, New York.

Chicago Office, - - - - - - - 936 Monadnock Block.
Philadelphia Office, - - - - - - 929 Chestnut Street.

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(Entered as second-class mail matter at the New York Post Office.)

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Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

NEW YORK, SATURDAY, JUNE 10.

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The Peace Conference Programme.

He would be a wicked man who did not wish well to the Czar's Peace Conference which began last month at the Hague, and all must be desirous of good results from its work. But it does seem to us a mild protest is in order against part of the programme as embodied in the circular sent out by Count Muravieff setting forth the principal question that might fittingly come before the conference. Article II. aims to prohibit any new kind of firearms whatever, or new explosives, or powder more powerful than those now in use. Article III. is opposed to the use of balloons for throwing explosives, and Article IV. proposes "To prohibit the use in naval warfare of submarine torpedo boats or plungers or other similar engines of destruction." We trust no misapprehension will attend our remark when we say that this is all wrong. The successful submarine boat, for example, would be a splendid forward step in the arts of war as making for a swift and sure peace. Every gain in deadliness of weapons has shortened the duration of war, and the suppression of submarine boats does not appear to us a very modern method of dealing with the problem. The same is true, we think, of the use of balloons. The plan, in fact, resolves itself into a proposition that the ingenious nations shall have no advantages over those sticking to bolos and bows and arrows.

Early Electric Locomotives.

One of the most interesting historical features of the Electrical Exhibition of 1898 was the "Joseph Henry" electric locomotive, built and used by Prof. Sidney H. Short in Denver in 1885 and applied to street car traction. A similar object of great interest happily found its way to the electrical show just closed, in the shape of the remnants of Edison's electric locomotive of 1880. Through the courtesy of Mr. Edwin W. Hammer we are able to give opportune publicity for the first time to the full story of Mr. Edison's railway work at Menlo Park from 1880 to 1882.

It will interest our readers to see just how far Mr. Edison went, and it is to be desired that more of these early records could thus be given the light of day while the chief actors in the events are living and when the probability of every statement can be tested. Even, then, as the stories of our late war with Spain show, there will be many strange gaps and hopeless contradictions. In the present instance, it is to be presumed that Mr. Hammer's narrative thus set forth with much care and particularity, will be accepted as the authentic version of what happened in railway work in those swift, prolific days on the Menlo Park hillside.

And yet it is a little odd that Mr. Edison did not go into street car work. We find him, in a characteristic fashion, it is true, tackling the big problem, and he was thinking chiefly of the heavy work done or left undone by the steam railroads. It is true he hauled a street car, but he hitched a locomotive in front. The truth is that in those early days the coming magnitude of the street railway industry was hardly dreamed of, and the self-contained car had not begun, even in prophetic vision, its all-conquering career.

PRICES OF APPARATUS.

Attention has been called recently in some of the public prints to the higher prices charged lately for electrical apparatus, and mention of the fact has been accompanied by comment that would imply the existence of a belief in the desire of electrical manufacturing companies to be extortionate. In reality, while there has been in some instances an advance ranging from 25 to 50 per cent., the price of such apparatus is far too low still if measured by the increase in the cost of material entering into the production of such goods.

A little investigation will justify this statement. Within the last nine or ten months, wrought iron pipe has advanced 100.9 per cent.; pig tin, 61.8 per cent.; copper, 57.2 per cent.; malleable iron castings, 57.5 per cent.; pig iron, 56.8 per cent.; brass, 37.2 per cent., and crude rubber, 21 per cent. Here we have an average increase of nearly 44 per cent. on eight articles of consumption entering more or less into the make up of electrical goods and apparatus. In view of such facts, any man who complains of the higher price of electrical apparatus is unreasonable. Such apparatus was never so good and cheap before as it is to-day.

TO CENTRAL STATION MEN—BUY AN AUTOMOBILE.

The discussion at the recent convention of the National Electric Light Association on the subject of the relation of automobilism to the central station was fruitless so far as suggesting any general course of action for the future. Opinion seemed to incline toward the policy of supplying current by meter from the mains at the automobile "stable," the current being used either direct or stepped-down in voltage by a motor-generator, or transformed from alternating to direct by apparatus there installed for that purpose. This system appears to have worked well in New York City, but as the same interest there controls the concern using and that supplying current, the example is scarcely apropos. Besides, the new question is one more apt to have disquieting features for those controlling the smaller rather than the metropolitan plants, which latter, with their superb business and technical organization, are amply prepared to cope with any situation presented.

The truth of the matter appears to be that the automobile as a factor in the electrical field has come so rapidly to the front, and the lines along which development will proceed are yet so indefinite, that a Micawber-like attitude on the part of central-station men is not unnatural, notwithstanding the danger to their interests that may be involved through delay in action. Until the situation does develop, however, it is incumbent on those whose interests are liable to be affected to be on guard that the introduction of the first few automobiles in their locality does not lead to the evolution of an independent system of current supply that may become permanently established and even develop into a rival in the lighting and power field. It is possible that the matter of the supply of electrical energy for automobiles may be developed by a process of evolution proceeding along lines leading away from the present central-station system of electrical supply. No one, of course, is more qualified to be the leading factor in the movement, whichever way it may tend, than the central-station man. If, however, he allows others to take the initiative, and permits the movement to get away from him, he may find in due time that that others have become proficient alone the new lines and that a profitable branch of the electrical industry has passed beyond his reach.

In the meantime the central-station man can stake a claim on the new field by becoming the owner of an automobile. Such a procedure will,in fact, be an anchor to the windward against most of the complications to which we have referred above. It will make him a leader in his locality in the new departure, and give him a preponderating influence in shaping the development of the branch. From the experience gained he will be able to appreciate any radical requirements that may be involved in automobilism, and will be in a favorable position to meet them in a manner most to his advantage with respect to his other electrical interests. Should the tendency be toward the central station as a source of supply, he can accelerate it, and in the contrary case should also be the one to profit, if profit there be. In any event, he will gain credit for enterprise and esprit de corps.

THE LOAD FACTOR OF HYDRAULIC AND TRANSMISSION PLANTS.

On first consideration it would appear that where the cost of power is immaterial, as in many water-power plants, an improvement of the load curve would not effect as great an economy as it would in steam plants where the steam consumption per kw-hour is so greatly affected by load fluctuations. In fact, at first sight it appears as though the cost of a storage battery to flatten the load curve would be quite warranted in plants where the raw material of the power transformation is free. In general, the saving accomplished by the leveling of the load line of a plant is largely due to the reduced cost of the machinery per kw-hour output, or, looking at it in another way, the increased output for a given amount of machinery. Where, of the total cost of power delivered, the fixed charges upon the machinery installed constitute an even greater portion than in steam central station work, any improvement of the load line might be expected to be of correspondingly greater value. Such is the case in water-power transmission plants, where frequently the cost of power in its hydraulic form is nothing and the cost of labor is comparatively small, the main element of the power delivered being fixed charges upon the equipment.

Several cases arise, the first and most general one being that where the flow of water is more than sufficient to carry the load at its highest peak. Here the saving effected by a battery is the difference between its interest, depreciation and attendance, and the interest and depreciation of the equivalent hydraulic, electric and transmitting equipment, the necessity for which at times of the peak is removed by the battery. In cases where the power is used wholly or in large part in the form of direct current, either at 250 or 550 volts, the battery reduces the size or number of the water wheels, electric generators, transformers, line wires and rotary converters, which apparatus is more expensive, as a rule, than that replaced by the same battery in a steam station; consequently, the economy effected is greater.

In cases where the flow of water is insufficient to carry the load at times of the peak, necessitating the use of a reserve steam equipment, the battery is of even greater valu.e Such an instance is that of the well-known plant at Hartford, Conn., a paper upon which by Prof. W. L. Robb is abstracted on another page. There the hydraulic storage is insufficient to back up the water at times of light load, rendering it unavailable at the time of the load peak, so that were it not for the battery, the auxiliary steam plant would necessarily be run every evening. With the battery the water, which would otherwise flow over the dam during the day, is utilized for charging during the hours of light load, the charge thus accumulated carrying the evening peak.

Still another case arises, although as yet examples which would fall under it are quite rare, and that is the existence of a load sufficient to more than absorb the whole hydraulic power even at the hours of light demand, the remainder being generated by steam equipments. In this case the effect of the storage battery would be only felt upon the steam plant, and the results would be more beneficial to it than in case no hydraulic power were used, as the "peak" load upon the steam station would be far more fluctuating in character than were the constant load carried by the hydraulic equipment added

to it. In all cases the storage battery serves as an emergency source of supply, even more valuable in the case of a transmission plant than in that of a local steam plant, owing to the liability of the complete failure of a transmission line, due to a falling tree, pole, or similar cause, which liability does not exist in the case of local steam installations.

ON THE DESIRABILITY OF NAMES FOR THE FUNDAMENTAL ELECTRIC AND MAGNETIC UNITS.

The eminent electricians of the British Association for the Advancement of Science, who thirty-five years ago undertook to prepare a system of universal electromagnetic units, did magnificent work, and amply earned our gratitude when they prepared the centimetre-gramme-second or C. G. S. system, of electromagnetic units. It is true the basis upon which magnetic magnitudes were connected with this system was imperfect, and that what has been called the rational or rationalized system of C. G. S. electromagnetic units would have been preferable; but it is very doubtful whether it would be worth while changing our fundamental magnitudes for the sake of a nearer approach to perfection or simplicity in this direction. The existing C. G. S. system is here and the C. G. S. system will probably rest for long. While, therefore, we have no serious criticism to offer upon the excellent work of the British Association after more than thirty years of practical experience with the C. G. S. system, yet we have serious criticism upon its work in another direction. The British Association was not content, as it should have been, with the development of the C. G. S. system. It went out of its way to burden us with the so-called practical system of electromagnetic units which is a derivative of the C. G. S. system and which is sometimes known as the quadrant-eleventhet-gramme-second system, because each one of the practical units, ampere, volt, ohm, joule, watt, farad, coloumb and henry is so related to space, mass and time, as though the unit of space were the quadrant of the earth, instead of the centimetre, the unit of mass the billionth of a centigramme instead of the gramme, and the unit of time the mean solar second.

The object which the founders of the practical system had in view was the meritorious one of simplification, since the volt, the ampere and the ohm, as fundamental magnitudes, were directly within the range of convenient quantities well known to electricians. But there was no necessity for creating a new or practical system on this account, as experience has abundantly manifested. The farad, for example, has a most inconvenient magnitude for electricians, seeing that no electrician possesses a condenser or aggregation of condensers amounting in capacity to a single farad, and the microfarad, its millionth part, has had to be adopted. But the word microfarad is just as full of meaning as a unit to the electrician, as a farad. It is now evident that what the British Association should have done was to provide names for the fundamental C. G. S. units, and a complete system of suffixes or submultiples. Thus, if the fundamental C. G. S. unit of current had been named, say the "*flu*," and the prefix "*deci*" had been adopted for the one-tenth part, then the present ampere would a "*deciflu*." If the practical man found that the magnitude of an ampere was suitable for his work, he would speak and write of "*deciflus*," just as readily as he would speak or write of amperes, better satisfied than he is to-day, because he could choose the magnitude of his practical unit, which magnitude changes from time to time, according to commercial requirements. The ampere is now too small for the manager of a power distribution system, while it is too large for the electro-physiologist. The great advantage of such an arrangement would be, moreover, that all computations with "*deciflus*" would be, by virtue of the name, referred back to the "*flu*," which would be a fundamental C. G. S. unit; whereas, at the present time, all computations with the ampere are directly referred to the quadrant-eleventhet-gramme-second system, and it requires study and effort to reduce them to the fundamental C. G. S. system.

The more we develop our practical system of applied electromagnetics, the more weary do we become of the burdensome and entirely unnecessary practical system. Why should the students be bothered with the dual system? If he becomes familiar with the ampere-volt-ohm system he loses sight of the fundamental system to which all electromagnetic calculations must perforce be brought, and if he works in the C. G. S. system he is bothered by finding that these units have no names and are mere mental abstractions. What we want to do is to bring all our measurements, thoughts and observations into conformity with the fundamental C. G. S. system, and yet make it practical and convenient for those whose duties are practical and who have neither time nor inclination to concern themselves with the theory or the science. But there is no necessity whatever to alienate the practical man from the temple of the science, the doors of which should always be wide open to those who seek to enter. To give the practical man the quadrant-eleventhet-gramme-second unit, is to isolate him from real scientific knowledge of the science he applies. It is like the literature and language of China, where the written language is not spoken and the spoken language is not written. Our written language is the C. G. S. system of the mathematicians; our spoken language is the practical system of the quadrant-eleventhet-gramme, and the absurdity should be stopped.

The remedy is simple and ought to receive the attention of the next electrical congress. Give names to the fundamental C. G. S. units, and give names to a complete system of multiples and submultiples up to the fifteenth or twentieth powers of ten-positive and negative. It is of no consequence to the subject matter, whether these names are those of eminent electricians or whether they are Sanskrit roots. The agreement upon suitable short, clear monosyllables or dissyllables is the essential—the rest is detail for a committee. No one need be bothered about the names; no practical man need learn them if he does not want to do so. It is sufficient to have them for reference in the pages of our text books. The advancing generation of students will gladly adopt them, and in time the old practical system will largely fall into disuse in favor of the C. G. S. system. In other words, the ampere would be used but rarely, while the "*deciflu*," or whatever it would be called, would be used not only by scientists, but also by practitioners, with great advantage to both. As another example, the joule of the practical system is ten millions of ergs. If the prefix for ten million or 10^7, were, say, "*sept*," then the joule would be the septerg. After a little while scientists and students would be quite accustomed to this uncouth term, which would be full of meaning, and all calculations with this unit would instantly fall into the C. G. S. systems and equations. The practical man would go on using the joule as before, there being temporarily two words for the same quantity, until gradually the superior advantage of the fundamental units would displace the limited and circumscribed advantage of the practical unit, so that the joule would slowly disappear. Even if the term joule did not disappear, it would not matter, so long as the student recollected that a joule was a septerg. We do not want any more units. The C. G. S. system gives us all the units we require, but we want names for these, to make them more than mathematical abstractions and to give them the dignity of concrete quantities. No harm can be done by the creation of these names. The worst that can happen would be that they should not come into use, but the teachers and students in the electro-technical courses would be only too glad to avail themselves of such aid. Let the next electrical congress think of it.

General Meeting of the American Institute of Electrical Engineers.

The sixteenth general meeting of the Institute will be held at the Massachusetts Institute of Technology, Boston, on June 26, 27 and 28. The meeting of 1890 was held at the same place, and was quite largely attended, considering the membership at that time, which was only 540, or less than half the present number. The following papers are scheduled for presentation: "Polyphase Electric Testing Methods," by Prof. H. J. Ryan. "Symbolic Representation of General Alternating Waves, and of Double Frequency Vector Products," by Chas. P. Steinmetz. "Note on the Progress of the Closed Globe Arc Lamp," by Louis B. Marks. "The Cost of Operation of Some Building Plants in New York City," by Percival R. Moses. "Constant Current Transformers," by Prof. W. L. Robb. "Notes on Recent Developments in Single Phase Induction Motors," by Chas. P. Steinmetz. "Elements of Design Favorable to Speed Regulation in Plants Driven by Water Power," by A. V. Garratt. "Protection of Alternating Secondary Circuits," Dr. Cary T. Hutchinson. "Air Gap and Core Distribution (Part Second)," by Prof. W. E. Goldsborough. "Electricity in Coal Mining," by Prof. J. P. Jackson. Other papers suggested, but not definitely settled upon, may possibly be presented by A. D. Adams, S. E. Doane, E. A. Sperry and Prof. Laws. Among the objects of engineering interest which are likely to be visited are the Cambridge pumping station, the South Boston electric light station, the electric plant of the Union Railway station, the Atlantic Avenue Edison station, the central power station of the Boston Elevated Railway, the West End power station at Cambridge, and the new Boston fire alarm station.

Rotary Transformer "Pumping."

A patent was issued May 30 to B. J. Lamme for means whereby irregularities in the operation of rotary transformers or synchronous motors due to distortion of the magnetic fields of such machines may be obviated. It is stated that the immediate cause of all such irregular action or "pumping" may be primarily due to irregular speed of the generator, to difference in form of the e. m. f. waves of the generator and of the motor or rotary transformer, etc. The immediate cause of the pumping lies, mainly or largely, in the distortion of the field of the motor or transformer when its armature has been forced for an instant to run at a speed either slightly greater or slightly less than the normal or synchronous speed. This distortion of the field of the machines may be explained as follows: If the armature of either an alternating or direct-current generator or motor is carrying current, its ampere-turns have a cross-magnetizing effect on the pole tips or edges which tends to straighten one edge and weaken the other. The resultant field is thus shifted either forward or backward, depending on the action of the current. In the case of a synchronous motor at no load, there should be very little armature current, and therefore a small distortion of the field. If the speed is suddenly changed, however, the motor armature will take considerable current, the resulting field will be shifted, and the armature will tend to move into a new position. In doing this, the field distortion, wave form, etc., are somewhat changed. The armature takes a current in the opposite direction for an instant, so that if in the first case, it receives current as a motor, it begins to deliver power for an instant. This distorts the field in the opposite direction, and the armature tends to swing the other way. If in the one case it was accelerating in speed, in the other it begins to drop in speed. Thus the armature may get into a sort of oscillation relative to the normal or synchronous speed. This oscillation or pumping may be very small for a time, and gradually increase until it is so violent that the machine is thrown out of step with the system. The armature current due to the pumping is in turn a leading and a lagging current, which tends alternately to strengthen and weaken the field magnetism. The field current will also oscillate with the pumping of the armature. In a rotary transformer when an oscillation is started, incoming current represents more ampere turns than the current delivered, which will produce distortion as in a synchronous motor, and as the field alternately strengthens and weakens, the e. m. f. varies and the transformer pumps. The object of the patent is to prevent the alternate distortion and reduce it to a comparatively small amount by placing copper shields or plates over or around the pole tips or edges, and copper rings around the ends of the pole pieces. If these shields and rings are of sufficient section and properly placed, the alternate distortion of the field at the tips or edges of the pole pieces will set up secondary currents in the shields and rings, which will oppose the distortion and neutralize its effect. Thus, when employed in connection with a rotary transformer, they will, by neutralizing the magnetizing and demagnetizing effects of the armature currents, assist the machine to deliver a smooth direct current; and further, if the e. m. f. waves of the generator and rotary transformer are alike in form, the closed rings and shields acting as a secondary to the magnetizing and demagnetizing effects of the armature current, will tend to prevent injurious effects by reason of the flow of current between the two machines. The device illustrated consists of a flat strip of copper placed axially on each edge of the pole face, and a heavy ring of copper about each polar projection.

Early Researches in Wireless Telegraphy.

The current number of the London *Electrician* contains a letter from Prof. Elihu Thomson, in which he gives an account of some early researches in wireless telegraphy conducted by himself and Prof. Houston in 1875. Commenting upon the letter, which we reprint below, our contemporary says that with characteristic modesty the writer does not attempt to set up any new claim as antedating either Prof. Hughes or more recent investigators, but has merely had in view the contribution of one new item of interest to the history of wireless telegraphy. Yet, it is added, it will be seen that he and his colleague approach, as others have since done, the fringe of an investigation which, had they pursued it further, would have led them among the path so ably discovered by Hertz and utilized by Marconi.

The letter of Prof. Thomson states that the experiments of himself and Prof. Houston were made in 1875, and a brief account of the same was published by Prof. Houston, in the Franklin Institute *Journal*, at or about the time the experiments were made. The experiments were conducted in the Central High School building in Philadelphia, and were as follows:

A ten-cell bichromate battery was used to set in operation a Ritchie induction coil, capable of giving a 6-in. spark. The coil was set upon the lecture table in the Physical Department, on the first floor of the building. One terminal of the coil was connected directly to the water pipe system, so as to thoroughly earth it; and the other secondary terminal was led by a wire 2 ft. or 3 ft. long to a metallic vessel supported upon a glass jar as an insulating support. The discharge terminals of the secondary coil were set 2 in. or 3 in. apart, and during operation the gap was traversed by bright sparks, owing to the connection to earth and the capacity of the metal vessel which had about two square feet of surface. With the coil thus in operation it was found that all over the building, as in the basement, and in the rooms two floors above the room in which the coil was operated, there was an electrical disturbance which could be recognized by taking microscopic sparks—as from the point of a penknife—from metallic objects anywhere in the building. These sparks were quite plainly seen in daylight even from the larger metallic bodies; and by careful shading, so as to secure darkness, they were visible, by close watching, from the smaller bodies. It was recognized at the time that something in the nature of a quick wave or impulse traversed the surrounding space, due to the instant discharge of the insulated body across the spark gap. One curious observation was not published with the account given by Prof. Houston in the *Journal* of the Franklin Institute before mentioned. There was a piece of copper wire, having at its end a loop, projecting from the wall in one corner of the chemical laboratory, which was in the basement of the building, but not directly under the room where the coil was in operation. This wire was a disused signaling wire. It had no direct connection with the coil, but did rest against a steam apparatus, which in turn was connected to the water supply piping. In exploring the chemical laboratory for evidences of the presence of waves or impulses Prof. Thomson happened to note a slight ticking sound when he came near the wire, and succeeded at last in locating it in the end of the wire itself, by placing the loop close to his ear when it appeared at its loudest. He had intended at the time to investigate the cause of the sound, and why its apparent source should be located in the loop at the end of the wire, but other matters intervened. In conclusion Prof. Thomson says he does not intend by the account to set up any new claim as antedating either Prof. Hughes or more recent investigators in the field of wireless telegraphy.

Edison Electric Railways of 1880 and 1882.

BY EDWIN W. HAMMER.

TWENTY years ago the "Wizard of Menlo Park" was stirring up the scientific and commercial worlds by the announcement of one revolutionary discovery and invention after another. The press and public were clamorous for news of what was being done in that obscure little New Jersey settlement. They were exciting times. Learned disquisitions were written on the impossibility of "dividing the electric light," notwithstanding the fact that the electric light had been "divided" and the "wizard" had several hundred of his lamps burning on one circuit. Those were the days when mathematician Francis R. Upton was kept busy replying to press articles decrying the Edisonian claim to a generator which would return over 90 per cent. of the energy delivered to it, in electrical power; the days when gas stocks were going down with a rush and electric stocks were correspondingly inflated.

Those were, indeed, heroic times, and we, seated unconcernedly beneath our incandescent lamps, whirled along metropolitan thoroughfares or country turnpikes in luxurious cars electrically propelled, or busily engaged in some great electrical undertaking involving, perhaps, millions of money, are apt to forget the hard work, the steady plodding, the infinite pains, the exhaustless faith, the disappointments and triumphs of that quiet man of genius and indomitable will, at his Menlo Park laboratory, from 1878 to 1882.

The story of those times has never been told in comprehensive or connected form, but it is to be hoped that some day it may be; there is a wealth of information ready for the searcher, whose labor will be rewarded. We know that the old laboratory was the Alma Mater of many of our successful electrical engineers; names come easily of men who, like Charles Batchelor, of the New York Edison Company; F. R. Upton, of Edison Lamp Works fame; the late John Kruesi, of the Schenectady Works of the General Electric Company; Edward H. Johnson, of the Sprague Company; Francis Jehl, Charles L. Clarke, Samuel D. Mott, W. J. Hammer, Albert Herrick, Frederick Scheffler, J. H. Vail, Charles T. Hughes, W. S. Andrews, Martin Force, J. L. Hornig, C. A. Van Cleve, William Holzer, John Ott and Ernest Berggren, are a few of the many bright and successful men associated with Mr. Edison in those early days.

Although it is a matter of common knowledge and general acceptance that the incandescent lamp was first successfully produced in Menlo Park, it is surprising that so little appreciation is had of the pioneer work Mr. Edison did in dynamo and railway development. It will be the purpose of this article to relate some of the circumstances concerning this early railway work and to show that in 1880 Mr. Edison built a commercial electric railway which was eminently successful; that in 1882 he built a second and more ambitious road; and that many important problems were presented and solved and difficulties met and overcome, in these undertakings.

We must remember that Edison had been making some most valuable contributions to the dynamo art. He had developed the dynamo with low resistance armature and relatively powerful field magnets and had, as early as his caveat of Aug. 19, 1879, described it and its combination with the compound-winding of field magnets. He was the first man in the world to put the compound-wound dynamo into practical operation for the maintenance of a constant potential, and it is interesting to note that this use was in connection with electric railroading. He was thoroughly familiar—more so than any other living engineer or scientist—with the regulation and distribution of potentials and currents. He was accustomed to operating generators in batteries, connected in series or in multiple

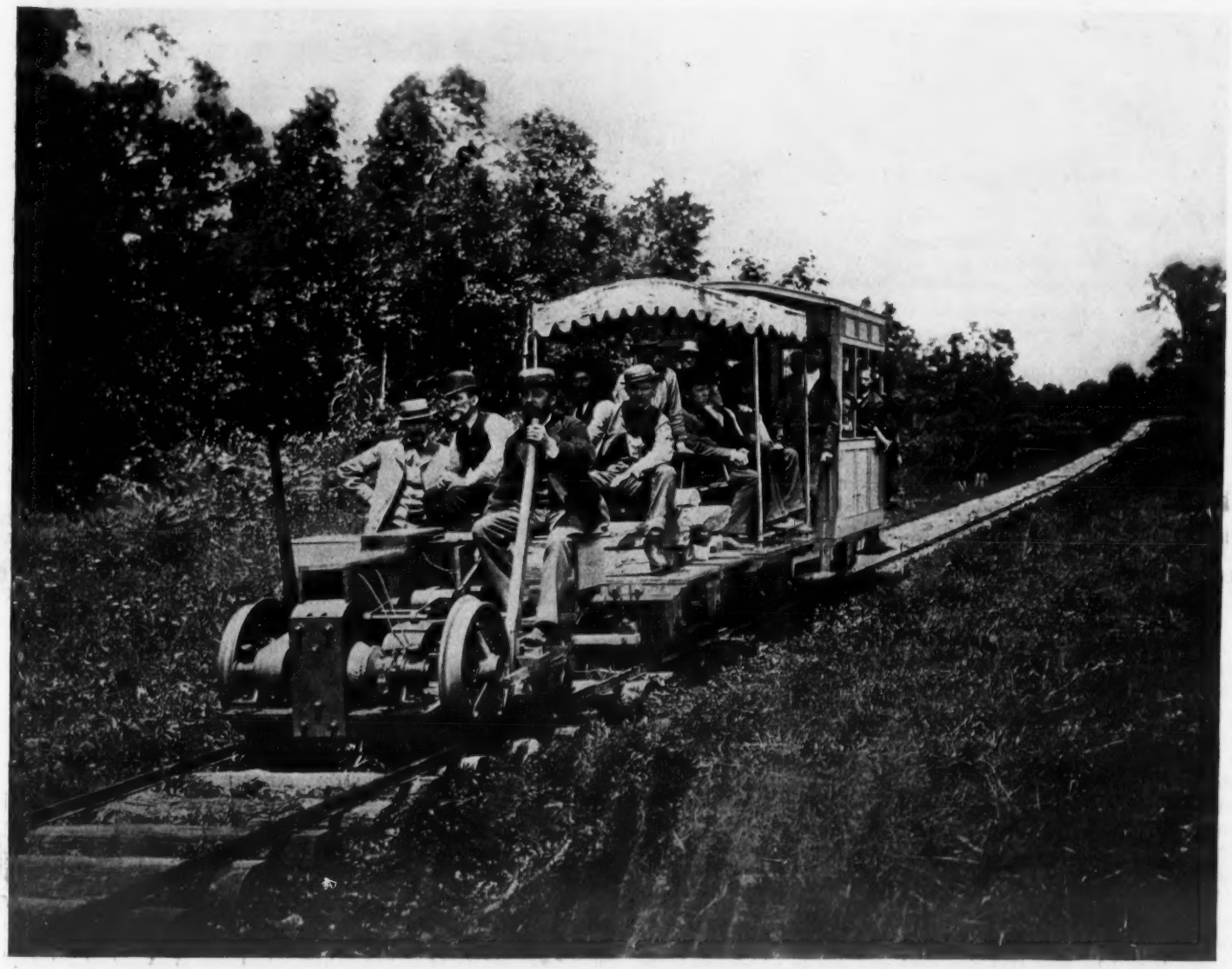


FIG. 1.—FIRST EDISON LOCOMOTIVE AND TRAIN, 1880.

arc, self-excited or separately excited, shunt-wound, series-wound or compound-wound. At his laboratory were worked out some of the most important laws relating to motors and dynamos, as well as to the distribution of electricity. This brings us to 1880.

We are complacent in our present knowledge perhaps, but we should stop to think for a moment as to what was the "state of the art" in those days. There was only one isolated incandescent lighting plant in the world—that at Menlo Park; not a single central station had been planned; "drop" in contemplated conductors was ascertained by actually measuring it upon a model, constructed to scale, with artificial resistances to represent lamps and small batteries to represent generators; the most powerful generator in the world was at Menlo Park and would give a current of about 75 amperes at 110 volts; the Edison "system" was just being evolved. But the brain of the inventor was ceaselessly busy; he was the person described by the then Commissioner of Patents as "the young man who kept the way to the patent office hot with his footsteps." Order was being brought from chaos and great things were in contemplation.

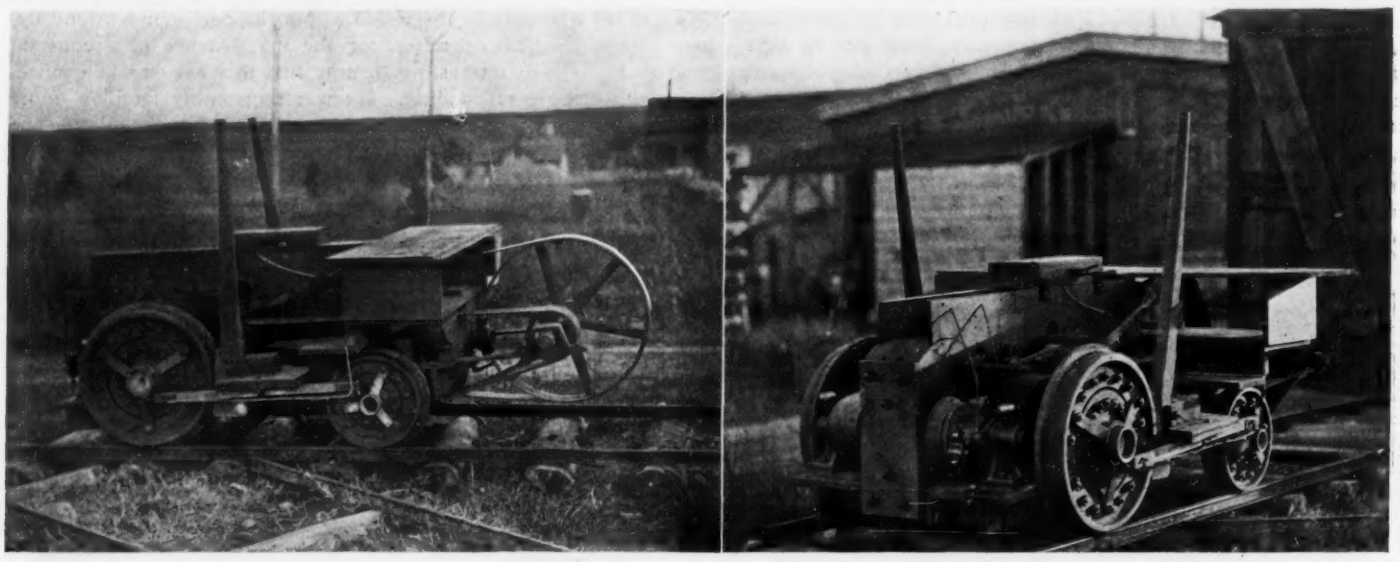
In 1878 Mr. Edison had been a member of a party of astronomers and scientists who visited Rawlings, Wyoming Territory, to witness the "Transit of Venus." Mr. Edison had invented an instrument, the tasimeter, for measuring minute changes in temperature, and he was desirous of trying it in connection with the transit observations. While on this journey he noticed that in the wheat lands of the West the farmers would sometimes transport wheat by wagon for two hundred miles and he conceived a plan, which he subsequently worked out in detail, for putting an electric tram-road in such neighborhoods to act as feeders to steam trunk lines. The trains on these roads were to carry no engineers or other operators, but were to be automatically controlled from stations along the way. In this manner, it was thought, the expenses of operation would be reduced to a minimum. His work in this connection, especially after the great improvements he made in dynamos and motors, impressed him with the entire feasibility of applying electricity for purposes of general traction and so, early in the year 1880, he began the construction of a piece of track near the Menlo Park laboratory upon which to make a demonstration of his ideas.

The section of road first laid was about one-third of a mile in length. The rails were light and were spiked to ordinary sleepers with a gauge of about three and one-half feet. The sleepers were laid upon the natural grade and there was comparatively no effort made to ballast the road, which started from a point about 50 feet from the machine shop and took a direction almost directly north along a country road.

The dynamos for this road were originally two in number, of the standard size then being made at the laboratory and were known as the "Z" type—in the laboratory vernacular, "Long-waisted Mary Anns." These dynamos were first placed in the machine shop and were connected to the two rails of the road by underground conductors. It will be seen that this road was one in which one rail acted as positive conductor and the other rail as negative conductor. These first dynamos were 110-volt machines and had a capacity of about 75 amperes each. No especial precautions were taken to insulate the rails from the earth or from each other and it may seem surprising that under these circumstances there was so little loss of current due to leakage.

The locomotive that was to be used on this road was being built while the construction of the roadbed was in progress. It consisted of a four-wheeled iron truck upon which was mounted a "Z" dynamo to be used as a motor. This machine was laid on its side with the armature in a horizontal position and the armature end of the motor pointing towards the front of the locomotive. The gearing originally employed consisted of a friction pulley upon the armature shaft, another friction pulley upon the driven axle and a third friction pulley which could be brought in contact with the other two by a suitable lever. Each wheel of the locomotive was made with a metallic rim and a centre portion made of wood or papier maché. A three-legged spider connected the metal rim of each front wheel to a brass hub upon which rested a collecting brush. The other wheels were subsequently so equipped. It was the intention, therefore, that the current should enter the locomotive wheels at one side and after passing through the metal spiders, collecting brushes and motor, would pass out through the corresponding brushes, spiders and wheels, to the other rail.

On Thursday, May 13, 1880, everything was in readiness and the various laboratory assistants gathered to see the fun. The laboratory engine was belted to the generators and current was delivered to the rails. At 4 p. m. the locomotive was packed with as many of the boys as could possibly find roosting places upon it, the switch was thrown over, the armature revolved and the engine driver brought his friction gearing into operation and they were off. It was a memorable occasion and everything worked to a charm until, in starting up at one end of the road, the friction gearing was brought into action too suddenly and it was wrecked. This accident demonstrated that some other method of connecting the armature with the driven axle should be arranged.



FIGS. 2 AND 3.—FIRST EDISON LOCOMOTIVE, OF 1880.

As thus originally operated, the motor had its field circuit in permanent connection as a shunt across the rails and this field circuit was protected by a safety catch made by turning up two bare ends of the wire in its circuit and winding a piece of fine copper wire across from one bare end to the other. The armature circuit had a switch in it which permitted the locomotive to be reversed by reversing the direction of current flow through the armature.

After some consideration of the gearing question it was decided to employ belts instead of the friction pulleys. A counter-shaft was put across the rear of the locomotive frame and the armature shaft was belted to a large pulley on this counter-shaft and a belt then ran from a small pulley on the counter-shaft to a larger pulley on the driven axle. The lever which had previously been employed to bring the adjustable friction gear into place was now equipped with an idler pulley which could be used to tighten the belt between the driven axle and counter-shaft. As now arranged, the locomotive could be started by turning on the current and allowing the armature to come up to speed before the main driving belt was suf-

ficiently tightened to apply power to the driven axle. Of course this meant that the belts must slip a great deal before the locomotive actually started and that, consequently, the belts would be badly burned at times. It also meant, as was very soon found, that if the belt was tightened prematurely, the armature would be burned out. This happened a number of times and proved to be such a serious

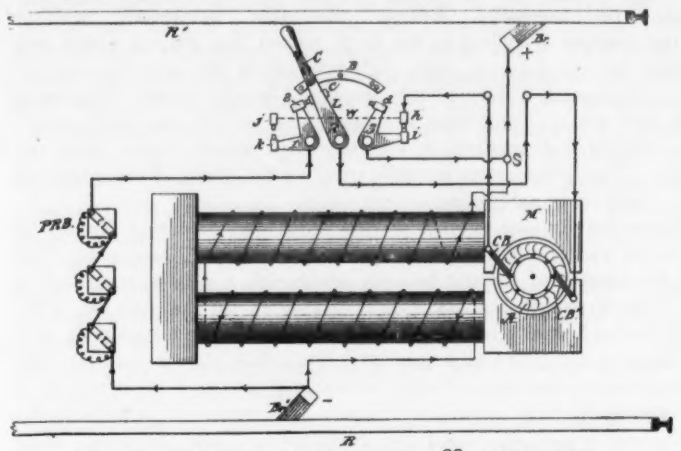


FIG. 4.—ELECTRICAL CONNECTIONS, 1880 LOCOMOTIVE.

annoyance that resistance boxes were brought out from the laboratory and placed upon the locomotive in series with the armature, This solved that difficulty. The locomotive would be started with these resistance boxes in circuit and after reaching full speed the operator could plug the various boxes out of circuit and in that way increase the speed. In stopping, the first operation would involve the opening of the armature circuit by the main switch and then applying brakes by means of long levers within convenient reach of the locomotive driver and his assistant.

This general arrangement proved very satisfactory, but Mr. Edison finally decided that the resistance boxes, which were scattered about the locomotive, under the seats, on the foot rests and platforms, were a nuisance and so directed Martin Force to take some No. 8 B. & S. copper wire and wind it on the lower leg of the mo-

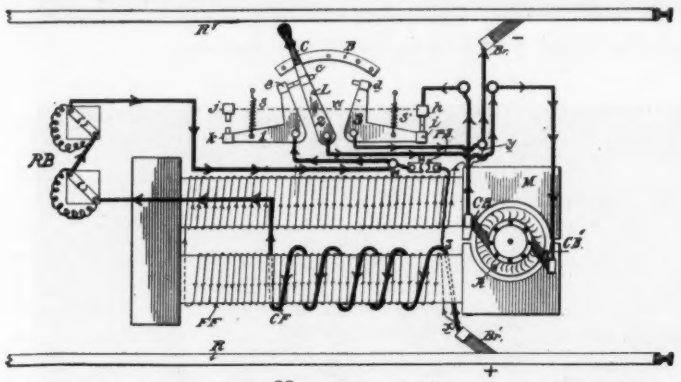


FIG. 5.—LOCOMOTIVE OF 1880, WITH SERIES COIL AS RESISTANCE.

tor field magnet. By doing this the resistance was put where it would take up the least room and where it would serve as an additional field coil when starting the motor, and it replaced all the resistance boxes which had heretofore been in plain sight. The boxes under the seat were still retained in service. Of course this coil of coarse wire was in series with the armature just as the resistance boxes had been and could be plugged in or out of circuit at the will of the locomotive driver. The general arrangement thus secured was operated with practical continuity as long as this road was in commission and will be found on this same old locomotive to-day. Visitors to the recent Electrical Show will remember seeing this interesting old relic of pioneer railroading there exhibited during the last week.

This locomotive was up to date in having an electric headlight and a signal bell; it carried thousands of interested passengers who made pilgrimages to Menlo Park from all over the world; and it was used in transporting all of the material necessary to the extension of this road from its original length of ⅓ of a mile to about 1 mile in length. When completed, the road was run in a northerly direction for about ⅓ of a mile, then turned to the left for about the same distance and then ran in a southerly direction for nearly ⅓ of a mile more. The very end of this road was at the bottom of a steep grade about 300 feet long which dropped about 60 feet in that distance. The curves were so sharp, the grades so steep and the speeds attained so great (as high as 42 miles an hour) that a number of derailments took place and there were several narrow escapes in consequence.

From the beginning there had been three cars in use on the road, in addition to the locomotive itself. One of these cars was a flat car used for freighting purposes, one was an open car with two park benches placed back to back and protected by an awning, and the third was a box car familiarly known as the "Pullman." All of these cars were built at Menlo Park. In Fig. 1 will be seen a photograph taken during August, 1880, of the electric locomotive and the three cars just mentioned. Mr. Charles Batchelor is acting as engineer on this occasion and will be seen with his left hand grasping the brake lever and his right hand on the belt tightener. Julius Hornig and W. J. Hammer are sitting on the sleepers piled on the flat car and Charles T. Hughes is standing at the right of the track. A number of other Menlo Park worthies are also in this picture.

A side view of the electric locomotive is shown in Fig. 2. The large pulley on the counter-shafting will be seen at the right hand or rear end of the locomotive and the belts leading to it and also to

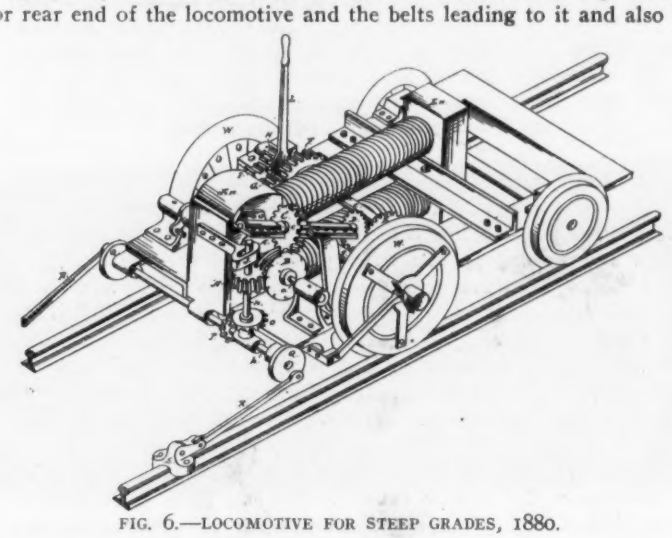


FIG. 6.—LOCOMOTIVE FOR STEEP GRADES, 1880.

the driven axle—the one equipped with the small wheels. The two brake handles are also shown, as well as the projecting handle of the reversing switch in the square box on top of the frame-work and the safety catch leading to the shunt field circuit, which has been spoken of above. Some of these parts are better shown in Fig. 3, which also shows the belt tightening mechanism. Both of these views show the construction of the wheels, spiders and collecting devices very well.

The character of reversing switch employed on this locomotive is very satisfactorily illustrated in Fig. 4, which shows the electrical connections of the motor before the heavy field coil was wound on

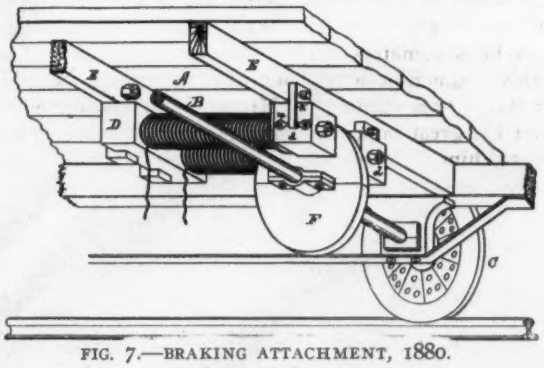


FIG. 7.—BRAKING ATTACHMENT, 1880.

the lower leg of the magnet and while the plug resistance boxes, *P R B*, were in use. Fig. 5 is a similar diagram of the electrical connections after the heavy coil was placed upon the motor in substitution for some of the plug resistance boxes; at the point *P S* will be noticed the plug switch for short circuiting this series field coil after the locomotive was in operation.

Later in the year the railroad generators were moved to a room adjoining the machine shop, opposite the end of the track, and were compound-wound to better regulate for the changes in load on the railway circuit.

This public exhibition of the railway naturally attracted much attention and numerous articles were written about it. The *New York Herald* for May 15, 1880, gave an account of the starting of the road and the accident to the friction gearing which has been mentioned. The *Scientific American* of June 6, 1880, also gave an interesting article in which editorial mention is made of a trip upon the road by representatives of the paper and a dozen other passengers at a speed of 25 to 30 miles an hour, up and down grades, around sharp curves and over humps and bumps, and that all were convinced there was no lack of power in the machine. The *Herald* of July 23, 1880, asks: "Why Not Apply it to New York's

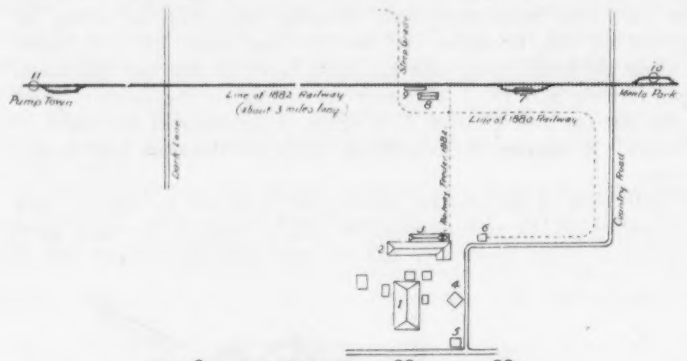


FIG. 8.—MAP OF ROADS, 1880 AND 1882.

Elevated Railroad?" This is followed by an article in the next day's *Herald* saying: "The possibilities of the future, * * * when the engines dashing through the streets shall be noiseless, dustless and smokeless, are most pleasing to the average New Yorker whose head has ached with noise, whose eyes have been filled with dust or whose clothes have been ruined by oil." The New York *Graphic* of July 27, 1880, also gave an admirable illustrated article upon the same subject. One of the illustrations was a sketch made by Mr. Edison of a proposed 100-hp locomotive to be used on the Pennsylvania Railroad between Perth Amboy and Rahway.

Many railroad men from all over the world visited Menlo Park and rode upon the electric railway. Among them were Messrs. Henry Villard and J. C. Henderson of the Northern Pacific; Messrs. Haines and Navarro, of the Manhattan Elevated; Mr. Frank Thomson, of the Pennsylvania, who died this week, and Messrs. Biedermann and Thury, of Switzerland. Many propositions were considered for electric railroads in various parts of the world, one being for a road in South America having such steep grades that special climbing apparatus would be necessary. Edison met this particular problem by the method described in his U. S. patent No. 265,778 which was applied for on July 22, 1880. This involved the use of a pair of grippers, operated by suitable gearing, which would alternately grip first one rail and then the other and so pull the train ahead. This device is illustrated in Fig. 6 of this article, taken from the patent. The scheme was actually tried on the Menlo Park road and was found to be effective.

Before leaving the subject of this 1880 road, attention should be called to an interesting adjunct to the "Pullman" box car. This was the system of electric braking employed, a system described in the Edison patent No. 248,430, also applied for on July 22, 1880. Each car-axle had a large iron disc mounted on and revolving with it, between the poles of a powerful horseshoe electro-magnet. The pole-pieces of the magnet were movable and would be attracted to the revolving disc when the magnet was energized, grasping the same and acting to retard the revolution of the car-axle. This structure is shown in Fig. 7, reproduced from the patent.

The first railroad was operated almost continuously during 1880 and a large part of 1881, but on Sept. 14, 1881, an agreement was entered into between Mr. Henry Villard and Mr. Edison, from which the following is an extract:

> "Edison will build 2½ miles of electric railway at Menlo Park, equipped with 3 cars, 2 locomotives, 1 for freight and one for passengers, capacity of latter 60 miles per hour. Capacity freight engine 10 tons net freight, cost of handling a ton of freight per mile per horse-power to be less than with ordinary locomotives. * * * If experiments successful, Villard to pay actual outlay in experiments and to treat with the Light Company for the installation of at least 50 miles of electric railroad in the wheat regions."

Mr. Edison says Villard paid between $35,000 and $40,000 on account of this road and that the work while eminently satisfactory did not result in the proposed road in the wheat regions because the Northern Pacific went into the hands of a receiver.

FIG. 9.—EDISON PASSENGER LOCOMOTIVE OF 1882.

Construction work began at once, but the road was not ready for use until early in 1882 and has consequently come to be known as Edison's 1882 road. The track was straighter than that of the 1880 road and the map shown in Fig. 8 will give an idea of its characteristics, except that the rolling nature of the ground is not there indicated. There were 3 sidings, two turn tables, a freight platform, japanning oven and car house, on the line of the road, which ran from a point above the laboratory buildings nearly due south to Pumptown, almost three miles away. This road was nearly standard gauge and was well and substantially constructed, with numerous trestles along its length; one trestle was 200 or 250 feet long and 10 feet high, another was 75 or 100 feet long and 2 to 4 feet high, a third was 75 feet long and 6 feet high, and a fourth was 75 feet long and about 2 feet high. There were numerous cuts and fills and every effort was made to have a thoroughly good roadbed. Current was supplied to the road by underground feeder cables from the dynamo room of the laboratory. The rails were insulated from the ties by giving them two coats of japan, baking them in the oven and then placing them on pads of tar-impregnated muslin laid on the ties. The ends of the rails were not japanned but were electro-plated to give good contact surfaces for fish-plates and copper bonds.

The passenger locomotive was the first one finished and it was used for hauling the ties, earth, rails, etc., used in building the road. The freight platform was at a point nearest the laboratory and material was carted there and then distributed along the road, as needed, by the locomotive and train of 6 or 8 small flat cars. Thousands of tons of earth and other materials were transported on the road in this manner.

The two 1882 locomotives were pretentious affairs, compared with that of 1880, having cab, cow-catcher, head-light, and other appurtenances, which made them look much like steam locomotives. The electrical features were very similar to those already described, but were worked out with much greater refinement of detail. The motor was placed on its side, as before, and was supplied with shunt and series field-windings. The series winding could be plugged out of circuit at will; resistance boxes supplemented the series winding and these resistances could also be plugged in or out, as desired. The resistance boxes were placed under the seats of the cab. Fig. 9 shows a front view of the 1882 passenger locomotive with Chas. T. Hughes at the "throttle." The power was transmitted to the driven axle by belts in a manner similar to that of the 1880 locomotive. Fig. 10 is from a photograph taken by the writer at Menlo Park in May, 1898, showing this dismantled passenger locomotive of 1882 in the foreground and the freight locomotive in the background; the former weighed about 5 tons when in commission and the latter about twice as much.

The freight locomotive had single reduction gears, as is the modern practice, but the power was applied through a friction-clutch as shown in Fig. 11 and Fig. 12, these photographs having also been taken at Menlo Park last year. The building shown in the latter view is the machine shop. The passenger locomotive was very speedy and 90 passengers have been carried at a time by it; the freight locomotive was not so fast but could pull heavy trains at a good speed. Many thousand people were carried on this road during 1882.

On June 19, 1882, Mr. Edison entered into an agreement with Charles W. Havemeyer, of Brooklyn, and Ernest Biedermann, of Switzerland, under which these gentlemen agreed to build works and install electric railways in Switzerland according to Edison's ideas, but this agreement was afterwards modified so they could handle electric lighting instead of railway apparatus. Mr. Edison's attention and that of the Edison Electric Light Company were being concentrated more and more upon the development of the lighting industry and railway interests correspondingly suffered. From the standpoint of the electric railroader it was a great misfortune that the financial difficulties into which the Northern Pacific road was plunged prevented the carrying out of Mr. Villard's comprehensive and broad-minded schemes for rural transportation. Had these gone through, electric railway history would doubtless have been made more quickly.

Following is a key to the references in the map, Fig. 8:—1. Laboratory. 2. Machine shop. 3. Dynamo room. 4. Glass house. 5. Office. 6. Locomotive house, 1880 road. 7. Locomotive house, 1882 road. 8. Japanning oven. 9. Freight platform. 10. Turntable, Menlo Park. 11. Turntable, Pump Town.

Telegraphy by Means of the Electric Light.

A patent was granted May 30 to Carl Zickler, of Brunn, Austria, on a system of telegraphy by means of electric light, to which reference has been made a number of times in our columns. In this method of wireless telegraphy, signals are transmitted by means of rays emitted from an arc lamp, the rays of short wave length (mostly ultra-violet rays) being the ones made use of. These rays are sent out from the sending station at intervals corresponding to those of telegraphic signals and in the direction of the receiving station, where they are made to produce weak electric waves, by which the signals are made visible as sparks, or are made audible by telephone or electric bell, or, if preferred, may be printed by Morse apparatus. At the sending station is an apparatus similar to a searchlight projector having either a reflecting mirror or lens or both in combination; if lenses are used, however, they must not be made of glass, but of rock crystal, in order to allow the ultra-violet rays to pass through them. The pencil of ultra-violet rays from the lens may be interrupted by means of a glass shutter which is operated by means of a bellows and a pneumatic ball such as is employed with photographic apparatus. The ultra-violet rays are absorbed by the glass plate, being only emitted when the shutter is removed. By leaving the shutter open for a longer or shorter time, the ultra-violet rays may thus be sent out in a manner to correspond with the dots and dashes of the Morse alphabet. The receiver consists of a tubular glass vessel closed airtight in front by a quartz plate. Within the vessel are two electrodes, one of which has a spherical terminal a few millimeters in diameter, and the other a small circular disk so inclined that the pencil of light entering the glass vessel falls upon it and is reflected to the knob of the other electrode. Both electrodes are covered with platinum foil and are separated about 10-mm. The air in the glass vessel is rarefied to a suitable degree or the vessel is filled with a rarefied gas. In front of the quartz plate is a tube fitted with a quartz lens, by means of which the rays coming from the sending station are concentrated upon the circular disk in a small, slightly illuminated spot. The two electrodes are connected with the secondary windings of a small induction coil. When the ultra-violet rays from the sending apparatus fall upon the disk-shaped electrode of the receiver, their luminous electrical effect causes sparking at the induction coil. The opening and shutting at the transmitting station in accordance with Morse signals, thus produces at the receiving station a transmission of sparks of shorter or longer duration according to the signals sent. In this way the signals may be made visible or audible or recorded.

FIGS. 10, 11 AND 12.—REMAINS OF TWO LOCOMOTIVES OF 1882, FOR PASSENGERS AND FREIGHT.

Electrical Radiation—V.

BY ARTHUR V. ABBOTT, C. E.

(Concluded.)

ONE great objection offered to the use of Hertzian waves for the conveyance of intelligence has been the supposed lack of secrecy, but no form of telegraphic apparatus now known is in the slightest degree secret. It is the easiest thing in the world to tap a telegraph line or listen in on a telephone wire, so that the only method of securing secrecy in systems now in vogue, consists in the use of a cipher or code, which, while it may be read by foreign parties, cannot convey to them intelligible information. With Hertzian waves it is not difficult to arrange the oscillator and receiver so that they must be syntonized to match each other's vibrations. Under such circumstances, while it is possible, it is exceedingly difficult for messages to be read by parties for whom they are not intended, as it requires considerable skill and patience to tune a foreign instrument to respond to oscillations of this description.

The most serious objection, however, is the lack of speed, for so far it has been impracticable to arrange transmitters and receivers to accomplish more than eight to twelve words a minute.

As bearing upon the commercial value of this method, an inquiry into the efficiency and delicacy of the coherer is interesting. The common six-inch coil indicated in Fig. 16 takes a current of ten or twelve amperes at a pressure of ten volts, thus absorbing about 120 watts. The efficiency of the coil is not over 30 to 50 per cent.; using the latter amount as most favorable to the coherer, about 50 or 60 watts would reappear in the spark gap, the heat, light and sound of which absorb at least 90 per cent. of the energy there expended, thus leaving not over ten per cent., or, say, five or six watts as transformed into pulsations through the ether. Suppose the coherer to be located at a distance of 50 feet from the coil. The area of the spherical wave is then $100^2 \times 3.14 = 31{,}400$ sq. ft., or 4,500,000 sq. in. Such a coherer as is exhibited in Fig. 15, without wings, exposes a surface of less than a square inch to the electrical oscillations; hence this apparatus can only absorb an amount of energy of a little more than one-millionth of a watt, and, calculating back to the energy

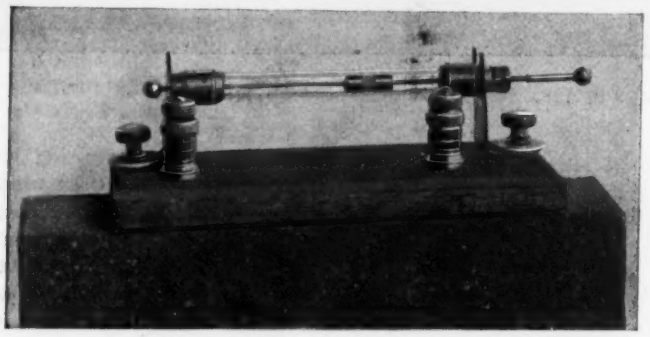


FIG. 15.—COHERER WITHOUT WINGS.

delivered to the coil, an efficiency of about one eight-hundred-thousandth of one per cent. is found.

By the use of a receiving plate and the most delicate apparatus, signals have been sent in England over a distance of 35 miles. Merely for the purpose of illustration, suppose, under such circumstances, the coil to consume 1000 watts and deliver 100 watts as radiated energy, and assume that the receiving station be supplied with a plate of 100 sq. ft. Probably all these quantities are in excess of those actually employed, so that the calculated results will be favorable to the coherer rather than against it. Under such circumstances, the spherical wave will be

$$70^2 \times 3.14 \times 5280^2 = 420{,}000{,}000{,}000 \text{ (approximately).}$$

and the energy delivered per square foot of surface will be

$$\frac{100}{420{,}000{,}000{,}000}$$

The amount received by the coherer will be

$$\frac{100 \times 100}{420{,}000{,}000{,}000} = \frac{1}{42{,}000{,}000}$$

say, one fifty-millionth of a watt, and the efficiency one five-hundred-millionth of a per cent. While such low efficiency is abhorrent to the commercial instinct of the calculating engineer, one stands amazed at the delicacy of the apparatus that will so swiftly and unerringly detect such minute quantities of energy as are represented by the amounts of the order of a millionth of a watt.

Telegraphing without wires—how attractive it sounds. No more unsightly pole lines disfiguring the streets and highways, ornamented with the dangling skeletons of by-gone kites. No more perpetual excavation of the streets, to find room beneath their surfaces for additional circuits that cannot possibly be crowded on to the staggering lines that darken the sky with their sooty cobwebs. A little instrument that one can almost carry in the pocket, certainly in a microscopic grip, and if your correspondent be likewise equipped, you may arrest his attention and talk to almost any time or place, with no intervening medium but the omnipresent luminiferous ether, a veritable 19th century realization of the dreams of the Rosecrucians. Possible? Certainly, but will it pay? For this is the final criterion with which this utilitarian age tests all such propositions, and for the present under ordinary circumstances, the answer must be NO. Nor is it difficult to decide for any given location and set of circumstances, which is the best method to employ.

To send messages with Hertzian waves, a transmitting and receiving station must be constructed and supplied with sufficiently powerful machinery to generate relatively enormous quantities of energy, and for each message, such a quantity of force must be expended that the receiver may be operated, with at best a ten-millionth of the quantity of energy expended. With a wire all the energy employed may be concentrated in a predetermined path, and not allowed to wander uselessly off into space. It is as if a man in the attic of a tall building, wishing to speak to another in the basement, should shout at the top of his lungs instead of whispering into a speaking tube. The sound waves would pulsate in all directions, and, while they might reach the desired correspondent,

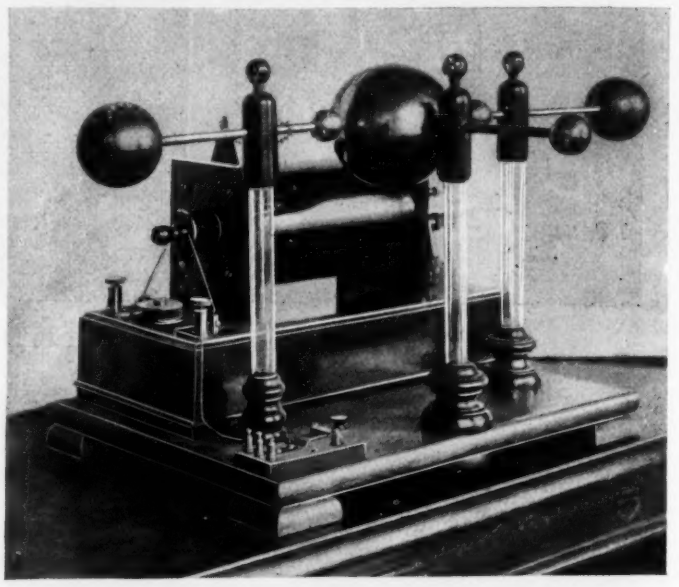


FIG. 16.—SIX-INCH COIL.

they would equally affect the entire neighborhood. With the speaking tube, on the contrary, the waves are so confined and guided that their energy is usefully expended to reach a given termination. If only one message is to be conveyed from attic to basement, or circumstances preclude the use of a speaking tube, the recourse to shouting might be either the only or the best plan to employ. Similarly with Hertzian waves, if only a few messages are to be conveyed if it is impracticable, or excessively expensive to erect a conducting circuit, wireless signaling may be advantageously employed. It is merely a question of comparing the cost of generating the necessary energy in the one case, with the expense attached to the conducting circuit in the other.

To reach a just conclusion the total expense of transmitting the required messages must be obtained for both methods, by considering the initial cost of installation, cost of operating and interest and depreciation on the two plants. By equating these results an immediate decision may be reached. Unless vast improvements are made in the efficiency of the oscillator and some way found of concentrating the energy along a predetermined path, wireless telegraphy will be of value only in cases where a connecting wire is impracticable. Between ships at sea; a lighthouse and the shore; a moving army corps; or a flying railway train; in the emergency of a broken cable; or as a warning to vessels approaching a foggy coast, this method of communication has already shown itself of

inestimable value. But unless vast changes and improvements now seemingly beyond practical realization shall be made, the familiar telegraph wire for the transaction of every-day commercial business will long remain. Yet Hertzian waves as a discovery of the highest scientific value, and the coherer as an instrument of the most marvelous delicacy, will go down in the ages as one of the great achievements of the 19th century.

Electrical Notes From Japan—IV.

BY PROFESSOR F. B. CROCKER.

ELECTRIC railways in Japan have been introduced to a limited extent, but will surely be increased and extended greatly in the future. The two principal roads are in Kyoto and Nagoya, both of which I examined. These systems are only of moderate size and are very much like electric railways in small American towns. The chief difficulties are those arising from the irregularity and narrowness of the streets in most Japanese places and their very crowded condition. Vehicles drawn by horses are quite rare, but the great number of jinrikishas more than makes up for this. In the large towns numerous pedestrians and swarms of children fill the spaces between the rikishas preferring the middle of the street to the sidewalks, even where the latter exist, which is not usually the case. Consequently navigation in these thoroughfares is extremely difficult, and is especially so for electric cars. Nevertheless they do succeed in running them fairly well, in the places already mentioned, by selecting the wider or less congested streets and by going at rather slow speeds. In Nagoya the principal streets through which the cars pass are exceptionally wide. Demand for transportation is enormous, for the Japanese, like other Orientals, love to travel and crowd in and out of the railway trains at every station. The result will certainly be that many favorable routes for electric railways will be found. It would not be a very serious matter to make a way by removing houses.

Being constructed chiefly of paper, it would seem that a man could easily dispose of several in a day if he had a good pair of scissors. It is a common occurrence for the buildings on one or more streets to be entirely destroyed by fire. Advantage might be taken of such an opportunity to "run in" an electric railway, American fashion, before an injunction can be obtained. The land might be condemned for the purpose by proper legal proceedings, but this would not correspond so closely with our rapid electrical methods of accomplishing results in such matters. The cars, overhead work and track construction are considerably below the standard of the best American practice, but this is quite natural in the beginning. Quality will improve undoubtedly in future installations on a larger scale. Their power houses are so much like small stations in the United States, that one feels very much at home in them; nothing unfamiliar strikes the eye except the racial characteristics of the employees. The cars have rather an odd appearance with their Japanese signs, conductors, motormen and passengers. This is feebly illustrated in the accompanying "snap shot" photographs, the brilliant colors of the costumes being lacking.

The manufacture of electrical apparatus in Japan is carried on to a limited extent, having made less progress than I expected to find. This is true of nearly all manufacturing which is not indigenous. In America, one often hears that Japan is, or very soon will be, capable of turning out electrical machinery, bicycles, sewing machines and men of war (these may all be called "Yankee notions") at lower prices than we can make them for, because of her very cheap labor. I know something of manufacturing, at least, in the electrical line, and gave special attention to this question while in Japan. My opinion is that for the present she may be rated a far less formidable competitor than is generally supposed. We must remember that it is only thirty-one years since the country was under a feudal system, very similar to that in Europe, during the middle ages. Her progress during that time has been truly remarkable, the most rapid the world has ever seen, but she is not yet abreast of the most advanced nations in those arts which only a few years ago were absolutely unknown to her. She is able even now to build a small amount of machinery, following closely American and European models, but it will take time to train a number of superintendents and skilled workmen sufficient to make her an important producer of machinery of any kind. Undoubtedly Japan will supply a certain portion of her own wants in this direction, in fact she already does so, chiefly because of a desire to encourage home products, but for years to come she will be a large importer of manufactured goods and it will be a still longer time before she becomes a considerable exporter of mechanical articles.

Passing from generalities to specific points, we find that the arts of making steel castings for field magnets and sheet iron suitable for armature and transformer cores are both undeveloped. These must first be brought to a highly advanced state before first quality electrical apparatus can be built. At present, the finish of Japanese machinery is decidedly inferior to that of American produc-

FIG. 11.—ELECTRIC RAILWAY CAR AT KYOTO.

FIG. 12.—TRACK CURVE AT KYOTO.

tions. Experience in materials and methods needed to secure the best insulation (the sine qua non of electrical construction), is also limited.

If cheap labor were the only factor, Japan would have an enormous advantage. Skilled workmen are paid 20 to 25 cents per day and unskilled about half as much. This being about one-eighth of the corresponding American wages one naturally asks how the amount of work done compares. The answer is that the Japanese machinist does not accomplish as much in a day as an American, but he certainly performs more than one-eight as much. He is considerably handicapped by poorer tools, lack of labor-saving devices, less experience in factory methods and economy; so that in the end it will be found that the total expenditure needed to make a particular machine is not so much lower in Japan than in the United States. Furthermore, in the case of electrical apparatus it is usually a fact that the materials cost two or three times as much as the labor, and since the former are more expensive in Japan, the difference will nearly balance the saving in the latter item. It should not be forgotten, also, that the machine produced is a somewhat inferior article when compared with one built in America.

Electrical engineering education in Japan has been brought to an advanced state very creditable to that country. The same is true of education in general, but especially of scientific and tech-

nical instruction. There are two Imperial universities, one at Tokyo, founded soon after the revolution of 1868, well known to electrical men as the place where Ayrton, Perry, Mendenhall and Ewing taught and first established their reputations. In the last catalogue of the University of Tokyo, the number of professors was 90, assistant professors 41 and assistants 90. The total number of students was 2239, those studying electrical engineering being 63. The other university, located at Kyoto, was started only a year or two ago, but is already in a promising condition. I had the pleasure of meeting nearly all the professors of science in both institutions and they very kindly showed me through their departments. Professor Namba, of Kyoto, and Professor Nakano, of Tokyo, who occupy the chairs of electrical engineering in the two universities, were more than courteous to me in every way during my stay in their cities. The organization and methods are not unlike those of our American colleges and technical schools. The teaching is more directly aimed at useful studies and applied science than in German, French or English universities. Latin and Greek or abstract studies are not given the prominence that they have in European institutions of learning. The lectures on electrical subjects are delivered in English or with a liberal use of English words, many of the technical terms not having any Japanese equivalent. Most of the educated men and many of the lower classes in Japan understand and speak English, and it is learned by all the university students as a requirement for admission. It is far more important than all other foreign languages combined. The electrical engineering instruction is based for the most part upon the practice in the United States and in Germany, the professors being from personal observation familiar with the methods and apparatus employed in those countries. The Japanese professors almost without exception have studied the theory and applications of their subjects in Europe as well as America. In most cases one finds that they have made very recent visits in order to keep themselves up to date. There is no dust on their information. In addition to the two universities for advanced education, where men are trained to fill the highest engineering positions, there are technical or trade schools where boys are fitted to become skilled workmen and foremen in manufacturing establishments at Tokyo. I visited one of the most important of these, and was much impressed by the excellence of the methods, personnel and equipment of this institution, which is called the Tokyo Kogyo Gakko (Technological School). The students are taught to use their heads as well as their hands, sufficient instruction in theory and principles being given to enable them to intelligently work themselves and direct others. The proper balance between theory and practice appears to be admirably adjusted.

On Wireless Telegraphy

BY PROF. A. E. DOLBEAR.

THE widespread interest in this subject manifested by the experiments now being carried on, and the articles written about it embodying theories of all sorts, makes it seem to me to be worth the while to attempt to make some distinctions which have heretofore received but little attention.

It will be remembered by some that in the early days of the telephone there were always to be heard the telegraphic signals from adjacent circuits even though the telephone line was relatively short. When the line was made longer and placed parallel with the telegraph lines, it was often difficult to hear what was spoken, and if a Wheatstone transmitter was at work it became absolutely impossible to hear a word. The explanation given was always *induction*. The circuits were parallel and the cure was to be the separation of the two circuits to such a distance that the induction should be at a minimum. This was done in many cases, relieving the trouble in a degree, but often not to the degree expected. One line I knew of was removed thousands of feet from other lines and when having to cross the telegraph lines, crossed at right angles and approached no nearer elsewhere than half a mile, yet then the trouble was very great. Another case was noted and much puzzled comment was made upon it. A telegraph circuit to New York had its Boston end grounded in earth as was common and is yet. A telephone line was built running north from Boston, its city terminal was buried in the earth at a distance of many feet from that of the telegraph line, yet it was found that all the telegraph signals on the New York line could easily be heard in the telephone line. This was supposed to be explained by induction between the terminal buried plates.

The experiments of Prof. Trowbridge, of Harvard, in 1880, made all these phenomena clear and added appreciably to our knowledge of the behavior of electric currents in the earth. As these experiments are not so well known as they deserve to be, for I have not chanced to see them alluded to, it may be well to briefly describe them. Between the Cambridge Observatory and Boston, a distance of about four miles, there was a telegraph line for transmitting time signals and a clock beating seconds closed the circuit every second to regulate time pieces in Boston. Trowbridge set out to trace this current in the earth from the observatory. He employed a telephone with a wire about fifty feet long, each end of which could be stuck into the earth whenever he desired. With this detector he worked away from the observatory and found he could hear those second beats to the distance of a mile from the connecting wire at right angles to it, and at a greater distance than that from the observatory. He mapped out the region and noted that the current spread out to a surprising distance between the two places, but could not be detected very far from the terminals in the opposite directions. He then pointed out the application of this to the plan of telegraphing across a river and extended his ideal excursion to telegraphing to Europe without a cable. A dynamo circuit in America, one terminal buried in Greenland, the other in Brazil, and a Morse key for producing proper signals. A telephone circuit in Europe. One terminal buried in Norway, the other in Siberia. A current turned into the circuit on the American side would distribute itself through the earth at the Greenland end, some of it returning by the way of the western continent, some through the Atlantic ocean and some through Europe. What proportional part took any particular route would depend upon the degree of conductivity provided. Some of it would inevitably reach the terminal in Norway and traverse the telephone line and a signal of any kind produced here would be heard by one listening to the telephone on the European side. Now this plan, which is ideally correct, would enable one to telegraph to Europe without a connecting wire or cable, but it would be wholly by an *ordinary current in a shunt circuit*. Induction in its ordinary sense would have nothing to do with it.

This conduction of electricity in every direction when a conductor is provided makes it plain how the troubles got into the telephone circuits, not only from earth connections, but from climbing down and up telegraph poles provided with the best insulation, especially in damp weather. It appears that this phenomenon of the current in the earth was very early noted. In some of "Sturgeon's Annals" there is described the movement of a galvanometer needle in one circuit by a current in another circuit when the earth terminals were fifty feet apart, and still later it is recorded that attempts were made to telegraph across a river by the same means.

In 1882 I presented a paper on "Telegraphing Without Wires" at the Montreal meeting of the American Association for the Advancement of Science, describing how to employ it for various purposes, signaling between ships, between ships and shore, and in addition another method for signaling to and from a ship in mid-ocean, anywhere in the line of the cables. A cable paid out to run parallel with a submerged cable could have a current of any strength turned into it and this current would necessarily act inductively upon the cable lying on the floor of the ocean, any signals of the Morse type would affect the other cable and its receiving apparatus, not by conduction, but by induction, the greater the length and the nearer they were together the stronger would be the signals. This was described in some of the journals, I forget which.

The distinction between conduction and induction is, or ought to be, clear enough, yet that it is not kept clear is plain enough in the writings of many otherwise well informed. As I understand it, conduction implies a conductor, and the less its resistance the greater the current, other things being equal. Induction implies lack of conduction; the less of this the stronger the induction effect. The maximum being where the insulation is perfect. A perfect condenser, for instance, allows no current whatever through it, because there is no conductor. There is also implied another matter, namely, transformation of the electric energy in the conductor into a static stress in the ether.

The condition necessary for conduction in any degree is, matter. In its absence there is no conduction, therefore no current. All experience shows that the ether is a perfect non-conductor of elec-

tricity. If it be so what is the use of talking about electric waves in the ether, where there can be no electricity? It is quite like saying radiant heat, there is no such thing. There is radiant energy from the sun, but it is transformed into heat after it gets here. It is a case of the survival of old and inappropriate terminology, like the word azoic for all rocks underlying the Silurian. Induction is today used to mean, first an ether stress produced by an electrified body, and, second, the effect of the ether stress upon another body, two very different things. Ether disturbances of all sorts so far as our experience goes, travel at the velocity of 186,000 miles per second, and this quite independent of the source of the disturbance. Changing electrical conditions in a mass of matter produce changing stresses in the ether and so ether waves are produced. If everybody did not know this before Hertz's work it was because he did not think about it, or else he entertained the idea that an ether disturbance could travel with an infinite velocity; a proposition which was wholly without warrant from experience and negatived by all the evidence we had with physical energy.

When 60 years ago Prof. Henry arranged two parallel and independent circuits, one above the other, any distance apart and observed the electrical disturbance in the second circuit whenever he made an electrical change in the first circuit, he was employing inductive action and there was a radical departure from what was before known in electrical matters, and very different means and methods in signaling from one circuit to the other from that said to have been used by Morse in telegraphing across a river about 1850. The two are not comparable, except for relative efficiency. Both were telegraphing without wires in a sense, but one employed conduction, the other induction, using the ether direct.

One used periodic currents, the other periodic ether waves, the frequency depending upon the rates of change in the circuits.

Mr. Preece, of London, reports somewhere that years ago he was able to hear telegraphic signals in a telephone line parallel with a telegraph line and nearly four miles distant. He interpreted it as due to induction. It was at the time remarked upon as surprising, because of the unexpected distance. Still later, when two parallel lines were placed, one on the south shore of England, and the other on an adjacent island, both raised in the air, signals were transmitted, and that was thought to be due to induction between the air parts of the circuits, but there is good reason for thinking that a part, if not the whole of the effects observed, were due to ordinary conduction through the water and that so far the process did not differ in method from that of Morse and Trowbridge. Trowbridge and Preece had a much more delicate device for a detector than Morse had, and could therefore remove their receiving circuit to a greater distance.

In 1881, while experimenting with the static telephone I found that the latter could be quite detached from the transmitter line, and with as perfect insulation as was given by standing upon a block of hard rubber, and fifty feet distant from the line could hear speech readily and the sound of a whistle with a pitch of 4000 vibrations a second heard without the slightest difficulty. It was explained at the time as inductive action and ether waves identifiable up to 4000 vs. per second. Nobody at the time ventured to dispute the explanation or even consider it doubtful. The same result, though less in degree, was obtained by putting the insulated end of the transmitting wire in the ear. The talking and other sounds were all heard.

When an attempt was made to obtain a patent for doing telegraphic and telephonic work without a circuit, as that was then understood, the patent office refused it, saying that the proposition was "contrary to science and the plan will not work." A working model had to be sent to convert the office. It was a scheme for telegraphing without either wires or a receiving circuit, for an insulated individual cannot be called a part of a circuit without vastly enlarging the meaning of circuit, at any rate as held in those days. A little later the experiments were continued out of doors. An induction coil with automatic break action and a Morse key in the primary circuit was used, while one terminal of the secondary was in the earth and the other end discharged into the air, sometimes with a series of points and sometimes through a condenser and a brass sphere, and again with a kite covered with gilt paper raised several hundred feet with a wire instead of twine. The receiving telephone connected in the same way to ground and the aerial conductor. With such an arrangement I worked across a small pond in the vicinity.

Then it occurred to me that if two similar induction coils vibrating synchronally should have their secondaries so grounded as to charge the earth positively at one place and negatively at another there would be a current in the earth between these two places without any aerial return circuit at all. The electrical energy in the air terminals being transformed into ether waves without special direction, as must be the case when electric sparks are discharged into the air. The energy becomes ordinary radiant energy and is undirected.

In this case there is a directed current in the earth between the two induction coil terminals and this can be used for signaling between two particular points independent of distance or particular interference from other currents.

A patent was granted for this plan in 1886, and if it has not been worked out as it might have been it is not my fault. It is a method of telegraphing without wires by the employment of aerial discharges.

The same plan would give ordinary inductive effects between two elevated kites. The latter would be parallel and that Morse signals could be heard in one provided with a telephone there is no manner of doubt and that at the distance measured by miles. The only difference between this plan and early telephonic induction is that the lines are aerial instead of horizontal, though perhaps the electric condition of the air itself would keep the aerial wires charged and hence more sensitive than they would otherwise be just as an electrified electrometer is more sensitive than when it is not electrified.

And now comes the coherer and its possibilities. Sensitive to ether waves to an unexpected degree, probably, too, because it is already part of an electric circuit and more easily disturbed. So far as at present explained it is neither conduction nor induction between the spark and the coherer. It is simply radiant energy and there is nothing electrical about it, save the devices convenient for producing proper waves, just as there is nothing electrical about the light from an arc lamp. The lamp itself is merely a convenient device for transforming electrical energy into heat of high temperature. The carbon shines, not because it is electrified, but because it is hot.

Rotary Transformers and Storage Batteries as Related to Long-Distance Transmission.*

BY PROF. W. L. ROBB.

THE paper with the above title read at the meeting was stated by the writer, Prof. W. L. Robb, to have been prepared in response to a request from President Young to give at this meeting an account of the operation of the rotary transformers and storage battery installed and operated in connection with the long-distance transmission plant at Hartford.

The main source of power of the Hartford plant is a water power on the Farmington river about eleven miles from Hartford, and capable of delivering under the most favorable conditions about 1200 electrical horse-power at the switchboard in Hartford. The power is generated by two 600-kw 60 cycle alternators and transmitted to Hartford on the three-phase system under 10,000 volts pressure. The water power is supplemented by an auxiliary steam plant in Hartford, consisting of two compound condensing engines having a combined capacity of 1600-hp, which operate one 600-kw alternator and one 400-kw rotary transformer, the latter being so arranged that it can be connected with the engines and operated as a direct or alternating-current generator, whenever, owing to low water or other cause, the supply of alternating current is insufficient.

Two systems of distribution are used. In the central portion of the city the distribution is on the three-wire 220-volt direct-current system, all practically underground, the feeders being lead-covered cables drawn in cement-lined ducts. Outside the central portions of the city the feeder is supplied with two-phase alternating current at 2400 volts and the distribution is in general on the three-wire 220-volt system supplied principally from 10 and 25-kw transformers. This service is in part underground, but in general overhead.

Three rotary transformers supply direct current to the three-wire direct-current system. One has a capacity of 400-kw and is located at the steam plant; two have a capacity of 250-kw each and are located in the battery sub-station in the heart of the business section

*Abstract of paper read at the recent Convention of the National Electric Light Association.

of the city and about three-quarters of a mile from the steam plant. The storage battery has a capacity of 2500-hp hours at a 5-hour discharge rate. All three rotaries and the battery supply currents to the same three-wire system. The three alternators are always operated in parallel. At least one rotary transformer and storage battery are always connected to the three-wire direct-current system. The direct and alternating-current systems are consequently interlocked, and the whole plant, including alternators, rotary transformers and battery, is practically operated in parallel.

The rotary transformers are of the two-phase type, and so designed that by cutting in turns of the primary of the static transformers, the voltage of the rotaries may be varied between 230 and 360 volts. This wide range is necessitated by the fact that the rotaries are at times connected directly on the line, and at other times used in charging the battery, frequently at high charging rates. This wide range of voltage obtained from the rotary does away with boosters which would otherwise be necessary in charging. The rotary transformers are two-wire and simply supply the current to the outside wires of the three-wire system. The neutral wire is connected to the middle point of the secondaries of the two static transformers, this point being always midway as regards voltage, between the two terminals of the rotary transformer. The storage battery is at all times kept on the line for the purpose of regulation and to meet any emergency call for extra power. Two of the rotaries are started and brought to synchronism by induction motors built on the shafts; the third is brought to synchronism as a direct-current motor, the current for this being supplied from the direct-current system.

The three alternators, one operated by steam and the other two operated by water at a distance of eleven miles from the first, have been continuously run in parallel during the past three years and no difficulty whatsoever found in this method of operation. In the operation of the rotary transformers it was found that a very soft-

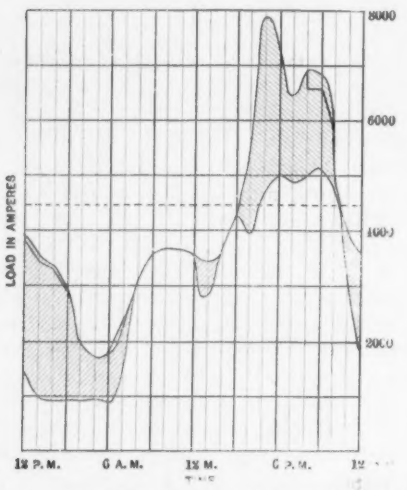


FIG. 1.—DIRECT CURRENT LOAD, WEDNESDAY.

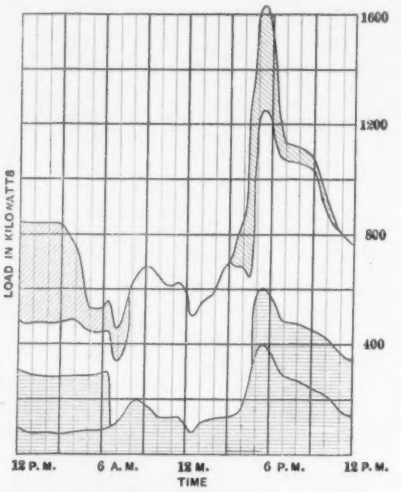


FIG. 2.—TOTAL LOAD, WEDNESDAY.

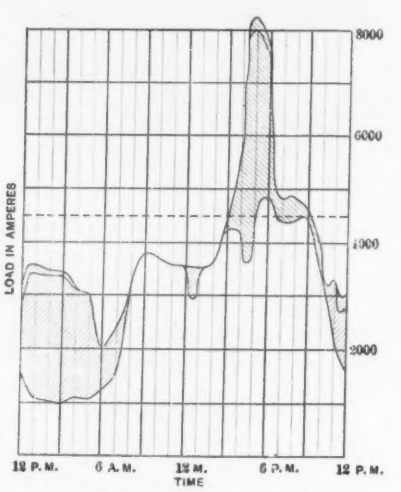


FIG. 3.—DIRECT CURRENT LOAD, SATURDAY.

for nearly three years and have had practically no repairs, the commutators being simply turned down once or twice a year.

The Hartford storage battery was bought under a five-years' guarantee which has since been renewed for an additional five years. The renewals have not been in excess of what was expected and no investment of the company has been considered more satisfactory than the battery. The method of deciding when the battery is to be renewed under the guarantee is, that whenever any plate or number of plates have lost one-third of the original capacity they are to be replaced by new plates. In this way the battery is being continually renewed and its capacity should never be less than 90 per cent. of its original capacity.

The accompanying curves were taken from the daily records of the company and illustrate the general operation of the plant and relative loads on the different systems. The parts shaded with horizontal lines represent the alternating-current load, the upper portion representing the series arc lamps. The part shaded with diagonal lines represents the charge and discharge of storage batteries; the lines sloping to the right representing the discharge and the lines sloping to the left the charge. The horizontal dotted line represents the total full-load capacity and direct-current machinery installed at the time. The unshaded area represents the direct-current load carried directly by the rotary transformers. An inspection of the charts representing the direct-current system shows that the average load on the rotaries during the twenty-four hours was over 80 per cent. of their rated full load capacity. The maximum load on the system was 83 per cent. more than the full load capacity of the rotary transformers. A comparison of the curves for the two days illustrates a great flexibility of the storage battery. On the Wednesday it was used at the high rate of discharge for a short period. On the Saturday the discharge was at a lower rate, but it was continued for a much longer time. The upper portion of the area representing battery charge and discharge, represents the

treated carbon brush gave the best results. The carbon brushes are first raised to a red heat and then plunged in odinary lubricating oil and allowed to cool. Vicious sparking that previously took place ceased when this type of brush was used.

At the outset, in operating the rotaries considerable difficulty was encountered from pumping when the engines were supplying power to the system. This pumping could be traced to the variation in the angular speed of the engines, there being little, if any, when the water power alone was supplying power. It was found that this tendency to pumping could be checked by varying the field of excitation of the rotary transformers, or by temporarily throwing a portion of the load on the storage battery.

A third rotary recently installed has operated perfectly by itself, but when thrown on the line with the two older rotaries, they immediately began pumping and it was found impossible to run the three together. Copper strips were attached to the pole pieces of the new rotary and the tendency of the system toward pumping was entirely overcome by this means. Even under the trying condition of running rotaries under different voltages, two feeding directly into the line and the third independently charging the battery, no trouble with pumping is now experienced. In all other respects the original rotary transformers have been all that could be asked for. They have run practically continuously night and day

charge and discharge of an isolated storage battery in one of the department stores.

The advantages of the rotary transformer and battery system to the Hartford company have, Prof. Robb considers, been very great. With the battery the company has been able to use a great quantity of water power that would otherwise have gone to waste. What would otherwise have been waste water power has been utilized at the peak of the load at the time when power is most valuable. The total output of the water power during the past year was over 90 per cent. of the possible output. When operating by steam, the engines have been run at an economical load, the advantages of the storage battery being nearly, if not quite, as great in connection with the operation of the steam plant as of the water plant. For example, during October, 1896, and during October, 1897, the plant was operated entirely by steam. In 1896 the battery had not been installed. The coal bill for October, 1896, without battery, was $4300. For the corresponding month in 1897, the batteries having been installed, the coal bill fell to $2600, notwithstanding the fact that the output of the plant had increased during the year more than 15 per cent .

The regulation of the system is much better with the battery than it could possibly be without it, and the service is much more reliable. The interlocking of the battery with the alternating

current by means of the rotary transformers makes the battery act as a regulator on the alternating-current system as well as on the direct. During the daytime on Sundays the entire load, both direct and alternating, can be carried by the storage battery. The battery has frequently been allowed to feed the alternating system through the rotaries.

The transformer and battery station is operated by three men: the superintendent, an expert in care of batteries, and two switchboard attendants. The labor in caring for a station of this output is a minimum.

The system could, of course, be operated with direct-current generators connected to alternating-current motors. This would necessitate in the place of each 250-kw transformer one 300-kw motor direct-connected to two 125-kw generators, and a smaller motor direct-connected to two boosters. The result would be a much greater investment in machinery, much greater floor space occupied, greater complication and expense of operation and a lower efficiency.

In summing up, Prof. Robb said that his Hartford experience has convinced him that the most satisfactory method of supplying electric energy over a considerable area is from a central power station generating alternating current; the current being distributed to rotary and battery sub-station of high voltage, and the energy locally distributed on the three-wire, direct-current system, except in outlying districts, where it will be found more advantageous to distribute on the alternating current system.

In the discussion which followed the reading of Prof. Robb's paper, Mr. E. A. Leslie said that during the past winter his company has operated two two-phase rotary transformers of 200-kw each, at a frequency of 60 cycles, and that the experience with the same has been entirely successful. Mr. Leslie in referring to the load line in Hartford, stated that he was surprised that on Saturday night the Hartford peak should be lower than on ordinary nights; the conditions in New York City uptown are just the reverse, the peak on Saturday night running beyond anything like that of the

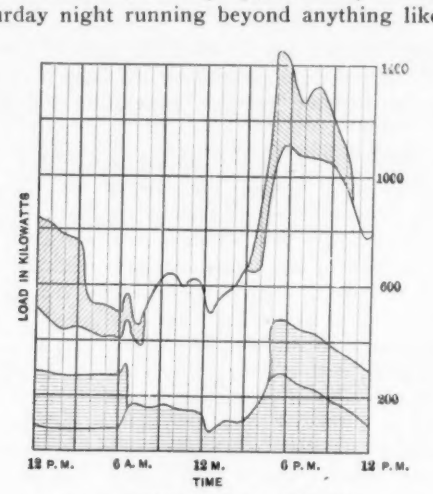


FIG. 4.—TOTAL LOAD, SATURDAY.

ordinary week day load and at the same time broadening up. In reply to a question, Prof. Robb said that the copper strips that had been applied to the field of the rotary prevented change in the magnetization of the field magnets; any tendency to change was thereby immediately dampened, thus obviating pumping. Pumping after starting increases progressively, and by means of the strip the pumping is checked at the outset.

In reply to a question as to the manner of obtaining regulation on each side of the system, using two wire rotaries with a storage battery, Prof. Robb said that the system is very nearly perfectly balanced as regards feeders at full load. At times of low load the feeders are simply pulled out of one side of the system until the balance is obtained at the junction boxes.

Mr. C. L. Edgar stated that in Boston where they have five or six large storage batteries, some of which are located so far out from the three-wire generating station as to be difficult to charge, the installation of an alternator has been discussed seriously during the past year. The plan is first to transmit high tension current to the various battery substations and then by means of rotary converters turn it into direct current. The question of obtaining the high tension current appears to resolve itself into putting in single-phase alternating dynamos run by engines, or dynamos generating both alternating and direct current, or taking the current from the three-wire system and transforming it by means of rotaries into high tension, raising the voltage by static transformers and carrying it about the city.

Prof. Robb added the further information concerning the third rotary transformer installed, that it differs from the others in that its shaft is continued out beyond the bearings so that it can be belted to one of the engines and used for generating direct or alternating current.

In answer to a question as to the experience at Hartford with series alternating enclosed arc lamps, Prof. Robb stated that a year ago a 30-light constant-current transformer was installed for operating such lights. The experience was so satisfactory and the lights ran so steadily that during the year that six 100-light transformers were gradually installed and at the present time are all running. Operating under these conditions, each lamp is supplied directly with 400 watts of alternating current, this being 150 watts less than formerly required to operate the 315 watt direct-current lamps, the direct current lamps being operated from series arc dynamos belted to a large synchronous motor. Alternating current series arc lamps have been in continuous operation since they were installed, and work with perfect satisfaction. The arc transformers are operated from substations consisting of a house 10 feet square on a piece of land in an out-of-the-way place behind some house or factory, in which are put two 100-light transformers. The transformers require no attention from the time they are started until they are stopped. The inspector of the district turns the lights on and off and is supposed to visit the house once during the night. There are Bristol recording ammeters in each substation and when the inspector starts the service he connects the ammeter on one of the transformers, and when he makes his inspection he transfers it, and the swing of the needle indicates that he has been there. The line on the recording ammeter is absolutely uniform, there not being a hair's breadth variation from 6¼ amperes from night to morning. The transformers are practically automatic and are made with two stationary coils, and two movable coils balanced on knife edges; all the motion is the slight motion at the knife edge when the transformer is started and stopped. Mr. Wagner stated that in St. Louis from 2300 to 2600 series alternating arc lights are in constant nightly operation, the lamps being operated from the various circuits by transformers placed in the substations. While the system is not as absolutely automatic in its operation as the system at Hartford, nevertheless but one attendant is necessary in the substation for an output composed of arc and incandescent lamps and power.

In answer to a question as to the relative photometric value of the open and enclosed arc lamps, Prof. Robb stated that the mean spherical candle-power of the open arc is greater, for the same energy consumed, but in the case of lights 200 or 300 feet apart, the difference in the illumination in the street does not vary much as between the two lamps. In Hartford the fact that the alternating current lamp does not give for the same watts as much light as the direct-current lamps is admitted, and about 25 per cent. more power is supplied; nevertheless the station output per lamp is less in the ratio of 550 to 410 or 415 watts than formerly with open arcs. The city contract calls for 315 watts per lamp, 1200-cp standard, and 400 watts are supplied.

CURRENT NEWS AND NOTES.

AUTOMOBILE SPEED RECORDS.—The latest speed record for an electric automobile in France is 63.6 miles per hour for the second kilometer in a run of 2-km. Four months ago the record was about 37 miles per hour. Such tests if continued will undoubtedly result in a funeral and a wreck. But it is well to have them.

PURIFICATION OF WATER.—The process of MM. Marmie and Abraham on the purification of potable waters has been on trial for some months in Lille, France. Ozone is first created by means of sparking discharges, the voltage being 30,000, and is then conducted into the water to be purified.

THE VOLTA CENTENARY.—King Humbert of Italy, on May 20, opened the International Exposition of Electricity and the National Exposition of the Silk Industry, commemorative of the centenary of the assembling of the first voltaic pile, or battery, the principle of which was discovered by Alessandro Volta, of Como. Crowds of officials and citizens were present and the King was given a great reception.

CHICAGO G. M. C. A. ELECTRICAL CLUB.—At the recent G. M. C. A. International Convention at Grand Rapids, Mich., the electrical classes and club of the Chicago association carried off the first prize for educational work. Mr. George A. Damon, assistant to Mr. B. J. Arnold, instituted this feature in the Chicago association, which might well be copied generally, particularly in the larger cities.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.—This association will hold its next annual convention in Washington, D. C., on Sept. 19, 20 and 21. The headquarters will be at Willard's Hotel. Willard's Hall, adjoining the hotel, has been secured for the display of exhibits. Arrangements will be made for the convenience of exhibitors, including the use of both direct and alternating current. Dr. Clifton Mayfield, 1335 Thirtieth Street, N. W., Washington, is chairman of the Committee on Exhibits.

A STATUE TO BENJAMIN FRANKLIN.—The University of Pennsylvania, the American Philosophical Society, the Franklin Institute, the Library Company of Pennsylvania, the Historical Society of Pennsylvania and the Pennsylvania Hospital, have issued a joint invitation to the ceremonies attending the presentation of a statue of Benjamin Franklin to the city of Philadelphia on Wednesday, June 14. Hon. James M. Beck will be the orator of the occasion. Postmaster General Smith will, in the name of the donor, present the statue, which will be accepted in behalf of the city by Mayor Ashbridge.

THE PHILIPPINE CABLE.—A Washington despatch states that despite the protest of the English cable company, which held a twenty-five-year franchise from the Spanish government for cable and telegraphic lines in the Philippine Islands, against the laying of cables by the United States in the Philippines, no change will be made in the plans of Gen. Greely, and the cable steamer Hooker, now on her way to Manila, via the Suez Canal, will upon her arrival there proceed with the work mapped out for her. No matter what the status of the Spanish concession might be in time of peace, it is held that no Spanish concession can interfere with United States military operations in the Philippines, and as communication between the islands is deemed necessary for the assertion of American sovereignty and the conduct of military operations, no attention will be paid to the protest of the English company.

EQUALIZING COMMUTATOR WEAR.—A patent was issued May 30 to Edwin W. Rice, Jr., having for its object to provide a device which will equalize the wear upon the collecting arrangements of dynamos and motors, so that the commutators or collectors may be kept true, require less attention and manipulation, and preventing sparking and undue wear. Instead of depending on the end play of the armature caused by a small imperfect balance or other mechanical arrangement, a regular reciprocation of the shaft in its bearings is obtained by means of an electromagnet. This electromagnet, which is of the annular form, is mounted opposite to the end of the shaft with its axis coincident with that of the shaft. The magnet is supplied with current either direct from the machine or from a separate source, and a commutating device breaks the circuit at such intervals as may be desired. By this means the shaft may be given a regular reciprocation, thus preventing "tracking" of the brushes.

ANNUAL MEETING OF THE NEW YORK ELECTRICAL SOCIETY.—The annual meeting of the New York Electrical Society for the election of officers took place at the Electrical Exhibition, Madison Square Garden, on the evening of Saturday, June 3. The following members were elected: Frank Gordon Rice, Chas. B. McLeer, J. C. Forsyth, Edward A. Mahar, Jr., Ernest R. Bartlett, Chas. M. Crowfoot, A. M. Young, J. Arthur Holly, Joseph M. Cooper and Henri W. B. Blomquist. The report of the secretary showed that 135 members were elected during the past year, and the total number of members now on the books of the society is 704. The average standard of the meetings has been appreciably raised, and the average attendance throughout the year has exceeded 200, thus breaking all the records of the society. The secretary said in his report that he did not recall any time when the society stood so high in public estimation, had a larger steady accession of membership, and could point to a better record in a year's work than now. The report of the treasurer showed that the society is in better financial shape than it ever has been. A detailed statement of the receipts and disbursements for the past year will shortly be mailed to each member of the society. The election of officers resulted as follows: President, Gano S. Dunn; vice-presidents, Dr. C. A. Doremus, Frank A. Pattison, Charles Blizard, Arthur Williams, F. V. Henshaw, Stephen L. Coles; secretary, George H. Guy; treasurer, Henry A. Sinclair. After the business meeting Mr. W. J. Clark lectured to a crowded audience on "The Future Possibilities of Wireless Telegraphy."

A NEW SYSTEM OF ELECTRICAL DISTRIBUTION.—A patent issued May 30 to Prof. Elihu Thomson relates to a system of distribution whereby constant current may be derived from a constant-potential alternating-current circuit, the object being to obtain the advantages of both systems and overcome some of the defects of each. By this means of distribution small conductors suitable for high-tension currents may be employed, thus giving a saving in copper, while at the same time the difference of potential between the mains or between the line and main is approximate to that of the constant-potential system. The regulation of the two systems is also combined in such a manner that although the source of current may be one designed for constant potential, the effect in the regulating circuit is that of constant current. The series or constant-current circuit connected with the main or constant-potential circuit contains a regulating transformer of the "tub" or air gap type, by means of which the current in the series circuit is maintained independently of the number of translating devices connected therewith. These translating devices may be placed in the circuit in series or connected through the intermediary of a transformer, and in any case an inoperative transformer or circuit may be shunted out without disturbing the action of the system. By the interposition of transformers the total effective potential of the circuit may be very much in excess of that of the main line, while at the same time at no point in the system can there be a greater potential difference between line and earth than the potential of the line. By one arrangement the system provides for a "tandem" generation of potentials as above referred to, the translating devices being in series; by another both constant current and constant potential circuits are fed from the constant current main circuit, but without "tandem" generation of potential.

MOTOR REGULATION.—A patent was issued May 30 to Mr. Robert Lundell on a method and means for controlling electric motors of the compound-wound type having two armature windings, two commutators and a field winding so constructed that it will be possible to run with a weak field strength without sparking at the brushes, and having its circuits so arranged that before a current change from series to parallel is made, the speed of the motor is so increased by reason of the weakened field, that it will approximate the speed obtained with a strong field after the change to parallel is made. By the system of regulation patented, it is claimed that an electric motor or a number of electric motors may be used conjointly in series-parallel combination without the aid of external resistances in the armature circuits, and in such manner that they will effectually return current to the mains at all speeds excepting the lowest for which they are adapted to run, and in such manner as to obtain the best economic results. Among the means of regulation are the grouping of the armature circuits in series-parallel combination, and changing the field magnet strength from a strong shunt and weak series for the lower speed combination to a weak shunt and strong series for the higher speed combination; changing the armature circuits from series to parallel and increasing the ratio of series ampere-turns to shunt ampere-turns upon the field after such a change is effected; the use of variable resistances for diverting part of the field current before the armature circuits are changed from series to parallel and for increasing the field currents before the armature circuits are changed from parallel to series, so that the speed obtained with a weak field and armature circuits in series will closely approximate to the speed obtained with a strong field and armature circuits in parallel; the employment of double field magnet and double armature windings, the armature windings being in series relation with one set of field windings having variable resistances located in shunt relation thereto; the other set of field windings being located in series relation with variable resistances together with circuit connections whereby the field magnet strength may be varied in such manner that the armature will restore or return electrical energy to the source of current supply for the lower speed combination of the motor, and will cause it to retain the qualities of a series-compound motor for the higher speed combinations.

LETTERS TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs—I note with interest an editorial paragraph in your issue of the 27th with regard to Transmission of Signals between the World Building and Madison Square Garden, during the electrical exhibition in New York. With proper apparatus and skill no difficulty will be encountered in accomplishing this result. My own experiments have indicated, however, that the transmission of signals in a city is a matter of considerably greater difficulty than is encountered in the transmission over an open space. While the iron frames of modern buildings do not, so far as I have been able to ascertain, present any serious obstacle to the transmission of ether waves, any space which is broken up by intervening obstacles, whether buildings, hills or forests, behaves towards the Hertzian waves as a muddy or turbid medium behaves toward the light; that is to say, the radiation is broken up and diffused in all directions by partial reflection, in such a manner as to both shorten the possible working distance and render accurate and careful adjustments of the instruments much more necessary. A. V. ABBOTT.

CHICAGO, ILL.

Measurement of Insulation Resistance.

To the Editors of Electrical World and Engineer:

Sirs:—If the writers of several letters on measurement of insulation resistance which have lately been printed in the ELECTRICAL WORLD should try the Burgess form of portable capillary electrometer in their work, they would find they had an instrument that so nearly fulfils all the requirements as to delight them. Mr. Burgess described the instrument and its use in a paper read at the Omaha meeting of the American Institute of Electrical Engineers (annual meeting for 1898).

Mentioning this matter reminds me that Mr. Burgess lately called my attention to the fact that Wehnelt's discovery of his interrupter was completely anticipated by the discovery of a Russian, which was made public fifteen years ago. A short description of the discovery of the latter will be found in the ELECTRICAL WORLD for January 17, 1885 (Vol. V., p. 27). DUGALD C. JACKSON.

MADISON, WIS.

[The article referred to was reprinted from London *Electrician*, and gives an account of experiments made by the Russian savant, Slouginoff, on the phenomena which ensue when acidulated water is electrolyzed by an intense current. He found that in such abnormal electrolysis a platinum wire cathode became so highly heated as to evaporate the nearest particles of liquid in such a manner as to interrupt the current; the liquid, thrown off by the vapor generated, again comes in contact with the cathode, and thus the intermittances of the current are repeated indefinitely. A greenish light appeared at the cathode, which was quickly disaggregated. Though several tests are described which proved the interruption of the circuit in the manner explained, it does not appear that Slouginoff applied the principle to the induction coil interrupter, though he experimented with a Ruhmkorff coil to observe the effect of the introduction in circuit of an inductance.—EDS.]

Electrolysis.

To the Editors of Electrical World and Engineer:

Sirs:—With reference to Mr. Goldstein's letter on the above subject in your issue of May 13, it appears to me that his difficulty arises in the confusion of the words "decomposition" and "electrolysis." In fact, to understand the whole point of Dr. Tommasi's paper it is necessary to make a very clear distinction between the meaning of the two words. As Mr. Goldstein points out, it is, of course, incorrect to speak of the electrolysis of water when the decomposition of water is meant, but I think he will find that few writers are guilty of this error, pardonable it is true, but nevertheless an error. I say pardonable advisedly, because it is easy to understand what is meant, and neither the reader nor the writer supposes that the direct decomposition is referred to, as that is practically unknown.

Contrary, however, to the statement made in your editorial note, it can be very easily demonstrated that the decomposition of water containing H_2SO_4 is due to a secondary reaction by the well known law of the migration of the ions, in which the concentration of the H_2SO_4 at one electrode and its impoverishment at the other show that it has played an important part in the electrolysis of the solution, and a calculation will show that it is exactly proportional to the amount of water decomposed, clearly demonstrating that the $+ H_2$ and $- SO_4$ ions have been undergoing electrolysis alone.

I would again point out, however, that if the distinction between the meanings of the words "decomposition" and "electrolysis" are kept clearly in mind, Dr. Tommasi's paper will be found quite in keeping with modern laws and definitions, and his statement that "the compound which absorbs the least heat tends to be *decomposed* in preference by the voltaic current" is correct, the words "decomposition by the voltaic current" not necessarily referring to the *direct* decomposition, or, in other words, the electrolysis.

ALFD. T. WEIGHTMAN.

SAULT STE. MARIE, ONT.

The Nernst Lamp.

To the Editors of Electrical World and Engineer:

Sirs:—As this subject appears of interest to your readers, permit me to state that many years ago I noticed the great fall in resistance of many of the earth oxides when subjected to high temperatures, and afterwards with a view to usefully applying this knowledge, I experimented considerably. But it was not until 1897 that I applied for my first U. S. patent for incandescent electric lighting by means of a tube or pencil composed of refractory earths or oxides, which at atmospheric temperature are good electric insulators, but when highly heated become good electric conductors and then incandescent under the influence of the current.

I employ very simple automatic means for lighting by first heating to conductivity the refractory medium by means of an arc, with which it is connected in shunt, and gradually withdrawing the arc to its extinction and maintaining that branch of the circuit open so that all the current is forced to pass through the refractory pencils, and so continues to heat and maintain them incandescent so long as the service of the light is required. When the lamp is switched off the carbons again come together ready to re-establish the arc and light the lamp. The pencils are all capped at their ends with metal or carbon so as to offer a large surface connection, which is a very important factor.

By using the tubular form of refractory pencil, the arc is established by solid carbons within the tube, which soon becomes heated enough to conduct the current to the exclusion of the arc, at which point it becomes incandescent. In the solid, round, refractory pencil the arc is established around it by means of hollow carbon pencils which loosely inclose the refractory pencil and form a protecting shield when not in use. The burning of the arc for a few seconds around the refractory pencil heats it to conductivity, when the arc will be extinguished and the pencil maintained incandescent.

The difficulty of making the oxide pencils conducting has been found no trifling one, and in the above method we have, it is submitted, a commercial solution. Of necessity there are, as in most other cases of radical departure from well-known systems, a number of points yet remaining for future investigation and consideration, before a perfectly successful commercial system, in all its details, is unquestionably assured.

This new light exerts at present a disturbing influence upon manufacturers, consumers and others interested in electric lighting, but I do not anticipate that it will immediately displace to a very great extent other lamps at present in use. Yet the time will come, unquestionably, when the light will bring about radical changes. It is submitted that this method of heating the refractory pencils to conductivity is preferable to the means resorted to by some other workers in the same field. W. E. IRISH.

CLEVELAND, O.

Free Cars and the Single Taxers.

To the Editors of Electrical World and Engineer:

Sirs:—Under the heading of "Street Railways for Nothing" you succeed in making the proposition of Mr. Tom Johnson look quite ridiculous and to appear very funny, but I think you do it only by

connecting two utterly unrelated things, and that if you had stated fairly and fully the proposition of Mr. Johnson it would have been perhaps less funny but more suggestive and possibly more instructive. It is not my province to defend Mr. Johnson, and I believe he is thoroughly capable of taking care of himself, and that very few of your readers will believe that a man who has so successfully managed very large enterprises would be likely to entertain ideas as ridiculous and absurd as those you ascribe to him.

You make it appear that Mr. Johnson would have the railways of Detroit carry passengers for nothing and at the same time pay him for the roads out of the earnings of the roads. I think you must know that Mr. Johnson has never proposed any such thing. What he does propose is that municipalities should own their own street railways, and that eventually when taxation has been adjusted on a basis permitting it to be done, then passengers should be transported on these railways free of charge. The philosophy of his position, as I understand it, is that all taxes should be levied upon land values exclusive of other taxes, and that as street railways increase the value of only one thing, that is land, this increased value is the proper source from which to build and maintain street railways. If you can cite any other thing, wages, dry goods, boots and shoes, horses, farm products or anything else that is permanently or materially increased in price by street railways, then you will have found another source from which such taxation may properly be raised.

You need not go outside of the building in which your offices are located to find this principle in working operation. You perhaps know, and if not, you can easily find by inquiry, that the upper floors of the building in which you are located are at least as valuable as and perhaps more so for renting purposes than the lower floors, except the one on the ground. The reason for this is that elevators are run in the building, which elevators give easy access to the upper floors and are free. That is, they are operated by the owner of the building, and his returns for their installation and maintenance come to him in the shape of rent payments which he would otherwise not get. But if instead of doing thus he sold or allowed to be stolen from him a perpetual franchise to build and operate elevators within the building, the owners of this franchise to charge what they please for conveying passengers and to give such service as they might find most profitable to them as elevator operators simply and without regard to the interests of the owner of the building or its tenants, then he would be doing just what the municipality does where public ownership is believed to be "socialistic" and all that. Tom Johnson believes simply that municipalities should do just what the owners of tall business buildings do in the matter of transportation, and it seems to me that if you will take time to really consider the matter a little you will perceive that it is not so excruciatingly funny after all.

S. T. FREELAND.

EAST ORANGE, N. J.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS

Armature Reaction.—Prof. Potier, in *L'Eclairage Elec.*, May 20, discusses in some detail the recent article by Picou (see Digest, April 15 and 29), in which the latter offered a new explanation of armature reaction and claimed that the usual conception is not the correct one. Potier does not agree with this. He shows that the results obtained by Picou were due to the particular construction of the machine with which he experimented; other experiments under different conditions would be necessary before accepted principles can be rejected. He discusses the experiments of Picou in detail.—Potier. *L'Eclairage Elec.*, May 20.

The original article by Picou is reprinted in the same issue.

LIGHTS AND LIGHTING.

Nernst Lamp.—A recent lecture by Prof. Nernst which was mentioned in the Digest last week, is abstracted briefly in the *Elek. Zeit.*, May 18. It seems to contain but little that was not published before, and is somewhat disappointing. In speaking of the energy radiated from a carbon filament, he states that by far the majority of the waves are of greater wave length than that of light, and that only 3 per cent. of the radiated energy consists of light rays, while 97 per cent. is heat rays. This ratio could be increased by increasing the temperature, but that is not practical with carbon, as has already been frequently pointed out. No corresponding figures are given for his lamp, but as the temperature is higher the proportion of light rays is considered to be greater. The light radiated from his lamp is in composition quite close to that of sunlight. At first he used only alternating currents, but subsequent trials have shown that the continuous current can also be used without appreciable electrolysis, which he believes is due to the fact that the oxygen of the surrounding air acts as a depolarizer, so that the electrolysis which takes place is not apparent (meaning presumably that the products of the electrolysis are reoxidized by the air as quickly as formed). He maintains that the small rods can be heated sufficiently high with a match to make them conduct. For the others there are two methods which seem practical; the one devised by Nernst is based on the use of a parabolic cylindrical reflector on the inside of which are secured a number of windings of fine platinum wire, while the rod is suspended in the middle of this reflector; the platinum wire is first connected in multiple with the rod of the lamp and the original current brings it to a red heat which is then concentrated on the rod at the focus of this heat reflector, and in the course of ten to forty seconds the rod is sufficiently heated to conduct; an automatic switch then disconnects the platinum wires and removes the rod from the interior of the reflector. In the second method, devised by Dr. Ochs, there is a small porcelain cylinder directly beneath the rod of the lamp and wound with a large number of fine platinum wires, which are first heated by the current; after the lamp is lit the cylinder remains in its position, but it is automatically disconnected from the circuit. Besides the information already given in previous notices, he states that the life of the lamp is 300 hours, after which the magnesia rod must be renewed, as it gradually becomes crystalline and brittle. The cost of renewal is therefore only small, and in spite of the somewhat higher first cost of the lamp, the cost of maintaining it for a long time is about the same as for incandescent lamps, while the cost of operation is less, owing to the greater economy in current. One-hp with the usual incandescent lamp will generate 240 candles, while in the Nernst lamp it will produce 480.—*Elek. Zeit.*, May 18.

A very brief notice of the lecture in the Lond. *Elec.*, May 19, states that he had not known of Jablochkoff's lamp until after he had made his own invention. It is possible to use the lamp with the continuous current if the filament is exposed to the air, as the depolarizing effect of the oxygen neutralizes the heating action of the magnesia. The preheating requires 10 to 30 seconds, according to the size of the lamp; the efficiency is 1.5 to 1.75 watts per candle.—Lond. *Elec.*, May 19.

Standard Lamp Base and Socket.—A reprint of the drawings with dimensions, of the bayonet lamp base and socket which is proposed for adoption as a standard in Germany by the Committee of the Union of German Electricians appointed for that purpose. It will be recommended for adoption at the next annual meeting in Hanover, presumably this summer. It is a bayonet socket having a pair of contact surfaces which make a flat rubbing contact with the base of the lamp.—*Elek. Zeit.*, May 11.

REFERENCES.

Arc Lamp Cutout.—Illustrated descriptions of what are thought to be one or two of the best forms of automatic cutouts.—Lond. *Elec. Eng.*, May 12.

TRACTION.

Electric Locomotives.—The conclusion of the long abstract of McMahon's paper (see Digest last week) is published in the Lond. *Elec. Rev.*, May 19. The paper contains a vast amount of data which cannot be given to advantage in a brief notice. Among some of the

general points brought out in the paper the following may be mentioned. A more rapid acceleration is shown to imply a much lower maximum speed which means less work to be done by the brakes and less loss of energy. His suggested maximum speed curve is claimed to be still more economical. The system which he advocates is the one usually followed in America; speed is gotten up to the maximum which can be allowed by the use of such powerful motors as would, if more powerful, cause the wheels to skid, thus utilizing the adhesion to the uttermost; if the section is long the speed is maintained at the maximum for some time, after which the train is allowed to run by momentum until the brakes are applied. A few figures are reproduced giving the results calculated for rates of acceleration per second between 1.46 ft. and 0.417 ft. per second, and it shows the great economy due to rapid acceleration. There is a wide margin of choice without increasing the expense of energy more than 6 per cent. If the speed curve can be kept a straight line during acceleration, improved results are obtained, and this is secured by keeping up the current by shunting the field when the current commences to drop; this reduces the tractive force per ampere, but is far more economical to shunt the field when the motors are in series before going into parallel and again after they are in parallel until the sparking limit is reached or the tractive force per ampere too low for economy, the field being then unshunted. He believes some relation exists between the number of conductors and the strength of field for the same armature diameter, which will give the best results. The principal result in the paper is that the series-parallel system of control is the best at present known, a fact which is generally recognized in America and hardly needs redemonstrating. The great benefit from high acceleration is also well known in this country. Some of the figures given in the paper appear to be useful as references in calculating new plants.—McMahon. Lond. *Elec. Rec.*, May 19.

A long abstract with a large number of illustrations which are not included in the above mentioned abstract, is begun in the Lond. *Elec.*, May 19.

Electric Automobiles.—A reprint of a short paper of a general character, the only information of importance in it being the following data: In the Paris automobiles the Fulmen accumulator is used largely; a cell weighs about 11-kg, giving 140 ampere hours at a mean of 1.9 volts and 28 amperes, thus weighing per hp-hour less than 30-kg. Forty-four such cells will run a carriage seating four to five people over good streets for 100-km (60 miles), or over bad streets at least 60-km (36 miles). The company charges 3.5 fr. (70 cents) per battery per day to maintain them, the cost of a battery being about $600. A Krieger carriage to which he referred, had two small motors at 2.5-hp each with a reduction of 10 to 16.8; thus for 30-km per hour the number of revolutions is more than 3000. Accumulators made by his company are used; 44 cells weighing 600-kg give 150 ampere hours; the motors are shunt wound with a compound starting winding and are connected in series or parallel; a single charge suffices for 100-km on good streets; the battery can be charged on down grades; the carriage weighs complete 1200-kg. The Scheele automobile has two motors and a chain transmission; there are 42 cells weighing 600-kg and yielding 75 ampere hours; the total weight of the carriage is 1600-kg.—Sieg. *Elek. Zeit.*, May 11.

Speed Records of Electric Automobiles.—*L'Ind. Elec.*, May 10, publishes the records made between December of last year to the end of April of this year, showing how the speeds increased. The times are given for the first, the second and both kilometers. In the last and best the time for the second kilometer is 34 seconds, which means a speed of 106-km or 63.3 miles per hour.—*L'Ind. Elec.*, May 10.

REFERENCES.

Potteries Electric Railways.—An illustrated description of this system of railways, which will be 33 miles in length and is considered to be an extensive scheme: the district covered includes seven important towns and many villages, and is around North and South Staffordshire.—Lond. *Elec. Rev.* and *Elec. Eng.*, May 19.

Stanstad-Engelberg Railway.—The beginning of a long, profusely illustrated article of this three-phase traction plant, briefer descriptions of which have already been referred to.—Reyval. *L'Eclairage Elec.*, May 20.

Surface Contact System at Tours.—A long description with many illustrations, of the line described in the Digest May 27.—*L'Ind. Elec.*, May 10.

Amiens.—An illustrated description of an electric railway constructed by the French Thomson-Houston Co. The total length is about 19-km.—*L'Elec.*, May 13.

Metropolitan Railroad in Paris.—A brief description of the present state of the work on this underground railroad.—*L'Ind. Elec.* May 10.

European Railway Statistics.—Tables abstracted from those which were noticed in the Digest April 8, and supplemented with comparative figures for previous years.—*Elek. Zeit.*, May 11.

Overhead Construction for Trolley Roads.—The first part of a long illustrated article describing and discussing those of the present systems of overhead construction which he considers have proved themselves to be the best. His suggestions are made as a basis for the rules and regulations which are soon to be prescribed for such overhead construction.—Schiemann. *Elek. Zeit.*, May 11.

Delivery Wagon.—A brief illustrated description with some data of the one made by Milde in Paris.—Lond. *Elec. Rev.*, May 19.

Submarine Boats.—Brief descriptions of those owned by private parties. The article is supplementary to the one noticed in the Digest May 27.—Marcillac. *L'Eclairage Elec.*, May 13.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

REFERENCES.

Charging for Electric Energy.—The continuation of the discussion noticed in the Digest Feb. 18. The author favors the Wright system as distinguished from the one used by Meynier at the Fecamp installation.—*L'Ind. Elec.*, May 10.

Operating Cost of Central Stations.—Brief communicated discussions of some recent statements in that journal.—Lond. *Elec.*, May 19.

Central Station Practice in Great Britain.—An unfavorable discussion of the recent article in the *Eng. Mag.*, noticed in the Digest May 20.—Lond. *Elec. Rev.*, May 19.

Interrupter for Storage Batteries.—An illustration accompanied by a brief description of the device noticed in the Digest May 27.—Petersen. Lond. *Elec.*, May 19.

Ferraris-Arno Distribution System.—A brief reference to the first application of this system at the exhibition in Turin. It is for starting simple alternating current motors while loaded; a transformer is used for displacing the phase so as to use two phases.—*L'Eclairage Elec.*, May 20.

WIRES, WIRING AND CONDUITS.

Rules and Regulations.—A reprint in full of those suggested by the committee appointed by the Union of German Electricians for adoption at its next annual meeting, for what are termed medium voltages, that is, from 250 to 1000 volts between any two wires, or one wire and the earth, is published in the *Elek. Zeit.*, May 18. The corresponding rules for voltages below 250 have already been adopted, as also those above 1000. They are also discussed editorially. It is hardly expected that it is advisable to adopt them definitely at the start, but to give them a one or two years' trial in order to test them in practice. Wood is admitted as a material for the construction of switchboards for an installation of not more than 10-kw; for larger ones the switchboards must be entirely of incombustible material, and in no case, not even on the small ones, is wood allowed to be used as an insulating material. The smallest height of uninsulated overhead wires is given as 5 meters (about 17 ft.), that for voltages below 250 being 4 and above 1000 volts 6 meters. These regulations apply chiefly to traction circuits. At 500 volts 60 ordinary incandescent lamps are allowed on one fuse; a fuse must stand continuously an overload of 25 per cent., and when cold must fuse within two minutes with double the current applied suddenly. Switches are required to disconnect all parts of the circuit, so as to leave no part of the disconnected circuit alive; for installations in a house there is an additional requirement that all disconnections must be made with one handle, that is, the two wires must not be disconnected with two separate switches. Switches in lamp sockets, that is, key sockets, are not allowed. The switches for arc lamps must be of the double pole kind and the switch must either leave the lamp earthed when cut out, or the lamp must be so arranged that it is not accessible until it is completely separated from the line wires. The insulation resistance is limited only to those installations which are in interiors and the value is higher than that for voltages below 250, in the ratio of 1 to 3; for separate parts the constant factor of 10,000 ohms is also contained in these requirements. For overhead wires an insulation resistance during rainy weather of at least 100,000 ohms per kilometer of single line is required.—*Elek. Zeit.*, May 18.

Rapid Method of Calculating the Weights of Conductors.—The following method is described briefly in *L'Ind. Elec.*, May 10. It is intended for rapid determinations and for comparisons between dif-

ferent metals. It is shown by a simple deduction that the mass of the whole line is equal to the square of the total length going and returning, divided by the resistance, this quotient being multiplied by the product of the resistivity and the density, which are two physical constants. The mass of a line of given length and resistance is therefore proportional to the product of the resistivity and density of the material used. As the cost is equal to the product of the price per pound of the metal, by the mass or weight, it is a simple matter, by preparing a table of these products, to rapidly compare the costs. Such a table is given for iron, copper and pure aluminum, for which copper and aluminum are equivalent if the price of the aluminum in these products are 78, 14.24 and 7.54 respectively. This shows that dollars per pound does not exceed double the price of copper; at present prices the two metals are about equal. If all the quantities in the above formula are expressed in absolute units, the mass of metal will be given in grams; if the length is in meters, the resistance in ohms, the resistivity in microhms per cm, then the mass of the wire in kilograms is given by the same formula as above, but multiplied by ten to the minus fifth power. For commercial copper at 15° C. the product of the resistivity and density may be taken to be 16, which will enable the weight of the copper to be calculated quickly for any given length, the resistance being known by the allowable loss.—*L'Ind. Elec.*, May 10.

Underground Tunnel Conduits.—The Lond. *Elec.*, May 19, gives a brief illustrated description, apparently from a recent patent, of a system devised by Morton and Kenney. Attention is called to the fact that in large cities like London where overhead lines are not allowed, the difficulties become very great, and it is thought that an entirely new method of dealing with the enormous number of telephone wires is required. The method described, is to construct special underground tunnels under all of the more important thoroughfares in London; these are to be airtight conduits of iron about 6 ft. in diameter, enabling access to be obtained without opening the streets. The cylindrical conduit shown has three vertical racks in which the cables are laid one above the other, and it is capable of accommodating 28,000 conductors; the branch cables are secured against the roof of the tunnel in such a way that any of them become accessible; these are tapped off from the main cables at suitable intervals. Each of the cables is intended to be for 1000 wires. In comparing the cost with that of running the same number of wires by existing methods it is claimed that a saving is effected of $55,000 per mile with ten cables, or $75,000 per mile with 36 cables. It is proposed to make the conduits in lengths of 12 ft.; also to use wire insulated with paper and not provided with a lead sheathing, as this considerably reduces the cost of the cable and the making of joints; instead they propose to maintain a constant moderate pressure of dry air inside of the conduits.—Lond. *Elec.*, May 19.

Mains.—A paper by Mr. Kilgour is reprinted in the Lond. *Elec. Eng.*, May 2-19. It consists of notes on the mains of the Cheltenham station and is largely descriptive in character, being accompanied by illustrations of various details. In that system there are 100-volt and 200-volt distributers fed from substations which are themselves supplied from the central by 2000-volt feeders. The alternating current is used; the feeders run untapped to the substations. Among other things, he states that it was found very desirable to have two independent connections for testing; he found galvanized iron cable quite useless for earth wires. The cables are all concentric and oil is used in the underground junction boxes.—Kilgour. Lond. *Elec. Eng.*, May 12.

An abstract, apparently in full, but not including the illustrations, is begun in the Lond. *Elec. Rev.*, May 19.

Fuses in the Neutral of a Three-Wire System.—According to the rules of the Union of German Electricians the neutral wire in three-wire or multiphase systems, is not allowed to be fused, nor are any bare wires which are intentionally earthed. Mr. Hess, in the *Elek. Zeit.*, May 4, questions the advisability of this rule when applied to neutral wires insulated from the earth. He assumes the case of a very low resistance fault outside of the main fuse, on one of the outer wires at the consumer's end of a three-wire system; in the inside of the house he supposes that the neutral wire, which according to the rules is not fused, has accidentally come into good contact with a water pipe, and at a point where the cross-section of the neutral has been reduced, that is, on a small branch wire of the neutral; the conditions are then favorable for igniting a fire. The current produced by the two simultaneous faults passes through the fuse at the central station or the transformer, the water pipe and a portion of the neutral wire as well as the whole of it back to the central station, but not through the fuse of the outside wires of that particular installation. It therefore flows through no fuse except the large ones at the central station which are generally of too large a capacity to protect that small portion of the neutral wire in the building, and a fire will no doubt result. He concludes that fuses in the neutral in every point where the cross-section is reduced by branch wires are not only not superfluous but are really necessary when this conductor is not permanently and well earthed. An editorial note following this states that it is a question of the choice between two evils. If the neutral wire is fused the danger arises which has been pointed out by Weber; if it is not fused the relations could exist as described above. It is thought, however, that the latter evil is decidedly the smaller and that it does not exist at all if the neutral wire is connected to earth, even only at one point.—*Elek. Zeit.*, May 4.

REFERENCES.

Earthing the Neutral Wire.—A discussion of the advantages and disadvantages of earthing the neutral at the station only and at various points of the supply area.—Lond. *Elec. Eng.*, May 19.

Interior Conduits.—The discussion is being continued in Lond. *Elec. Rev.*, May 12.

ELECTRO-PHYSICS AND MAGNETISM.

Ball Coherers.—Experiments have been made by Branly in which he substituted a row of balls 1-cm in diameter, for the metallic discs in his previous experiments, and found that the balls were much more sensitive; this is described in the *Comptes Rendus*, abstracted briefly in the Lond. *Elec.*, May 19. Brass gives no result and lead only feeble indications, but 10 balls of soft iron mounted one above the other showed an initial resistance of nearly 1000 ohms, which is reduced to 60 by a spark of 1.5-mm passing at a distance of 10-m; a slight shock sent it up to 1300 ohms and a second spark brought it down to 80. A coherer of six hard steel balls is about as sensitive as one of gold filings, which latter is known to be highly sensitive. The shock must be carefully graduated.—Branly. *Comptes Rendus*, May 1, abstracted briefly in Lond. *Elec.*, May 19.

Electrical Discharges.—Prof. Trowbridge, in a paper published in the *Amer. Acad. Proc.* 33, p. 435, abstracted briefly in *Science Abstracts*, April, gives an account of experiments with air and gases subjected to powerful electrostatic stress. In addition to the matter previously published, the following may be of interest. He found that when the initial resistance of highly rarefied air is broken down by Röntgen rays, it has less resistance than at a pressure of 2-mm, at which it is generally considered to have the maximum conductivity. There are anode Röntgen rays as well as those from the cathode, and they exhibit all the peculiarities of the latter. Röntgen rays can be produced with 10,000 volts and there are indications of them at 5000. Electrostatic induction is an important phenomenon in the production of Röntgen rays, the mechanism of their production being a setting up of electrostatic lines of induction along which the voltage acts, and the production of an electric wave or impulse.—*Science Abstracts*, April.

REFERENCES.

Diffraction of Röntgen Rays.—An account of some observed indications of real diffraction tending to give a wave length of one or two Angstroem units instead of the four or five thousand of the visible spectrum.—Haga and Wind. *Proc. Akad. Amsterdam*, March 25; abstracted briefly in Lond. *Elec.*, May 12.

Transformation of X-Rays.—The continuation of his long series of articles.—Sagnac. *L'Eclairage Elec.*, May 13.

Velocity of Electrolytic Reaction.—A study of the speed of chemical reactions by means of the electrolytic cell.—Cohen. *Proc. Akad. Amsterdam*, March 25; noticed briefly in Lond. *Elec.*, May 12.

Physical Properties of Bismuth.—A study of the four transverse galvano-magnetic and thermo-magnetic phenomena which co-exist in bismuth. The formula representing the general result is reproduced in the abstract.—Van Everdingen. *Proc. Akad. Amsterdam*, March 25; noticed briefly in Lond. *Elec.*, May 12.

Electromagnetic and Luminous Waves.—A theoretical article on the ratios of the dispersion of electromagnetic to luminous waves.—Barbillion. *L'Eclairage Elec.*, May 20.

Energy of the Magnetic Field.—A paper in which he proves that the usual expression for the energy of a magnetic field requires modification if the temperature is to be constant.—Pellat. *Jour. de Physique* 7, p. 102; abstracted briefly in *Science Abstracts*, April.

Thompson Effect in Copper.—An investigation to determine the Thompson effect in copper in absolute measure and its variation with

temperature. He found a diminution of the effect with an increase of the temperature, which does not agree with Tait's assumption of proportionality with the absolute temperature; the effect for other metals should therefore not be deduced in the usual way.—King. *Amer. Acad. Proc.* 33, p. 353; abstracted in *Science Abstracts,* April.

Electrical Radiation.—The beginning of an article in which the author discusses and explains the phenomenon of electrical radiation with the intention of throwing more light on the mystery of wireless telegraphy. He treats lines of force, whether electrical or magnetic, as something real and tangible, hoping thereby to convey a clearer meaning of electrical regulation.—Taylor. Lond. *Elec. Rev.,* May 12.

Electric Furnace.—A brief description of the Borchers furnace is given in the Lond. *Elec.,* May 10; it is intended for calcium carbide, but can be used for other processes. He claims to have improved the method of arranging and heating the charge and of utilizing the heat heretofore wasted. He avoids some of the disadvantages of the usual arc furnace by using the carbon as a resistance and packing the other substance around it, care being taken that it is not in a too finely divided state; he therefore generates the heat by resistance alone and not by the formation of an arc. In the usual furnace the material discharged is liable to become partially burned; portions of the charge fall out of the furnace; the gases evolved carry off a considerable quantity of the dust; the power consumed remains unduly high. These defects he endeavors to overcome by making the walls of the furnace thin, and enclosing it in a water jacket; the gases are passed through a filtering medium before discharging them; the lime in his furnace melts, is converted into carbide which flows away, allowing fresh lime to come in contact with the carbon resistance until this is consumed. An arc heating furnace is also briefly referred to. The heat in the block of carbide is utilized for generating steam. By utilizing the heat otherwise wasted he claims to obtain a saving of practically one-quarter of the power heretofore used, and the excess of charging material used to protect the walls of the furnace can be used over again without adding any more carbon to it.—Lond. *Elec.,* May 19.

Aluminum Manufacture.—In a French Academy paper by Minet, abstracted in *L'Eclairage Elec.,* May 20, he shows how the proportion of impurities in commercial aluminum have been reduced during the past nine years, especially the silicon; but the proportion of iron is still quite appreciable, having been in 1897 0.12 per cent., the aluminum being 99.86 per cent. pure. He claims that in several ways the iron can be made to disappear almost completely; three of these he describes briefly. The last one is to coat the interior of the crucible with a coating of carbon, and for the return current use an electrode instead of using the crucible itself as cathode; thus the coating will not take part in the electrolytic reaction and will last longer; the crucible can furthermore be kept cool so that it is attacked only very slightly. When the aluminum is to be obtained in the form of an alloy it is well to make the crucible of the metal which enters into the alloy, and the attacking of the crucible is then no inconvenience; it may also be made of aluminum and cooled externally so as not to exceed a temperature of 500°, that of the bath being 750; in that case a metal is obtained which will contain only traces of silicon.—Minet. *L'Eclairage Elec.,* May 20.

REFERENCES.

Thermodynamics of the Carbide Furnace.—An abstract with some of the figures of the article noticed in the Digest May 27.—*Elek. Zeit.,* May 18.

Electrolysis of Zinc Chloride Solutions.—An abstract of the article noticed in the Digest Aug. 6, 1898.—Foerster and Guenther. Lond. *Elec. Eng.,* May 12.

Electrolysis of Calcium Chloride.—An abstract of a paper noticed in the Digest May 14, 1898.—Bischoff and Foerster. Lond. *Elec. Eng.,* May 5.

Plating Tubes with Zinc.—A description of the Cowper-Coles process used in England with special reference to the regeneration of the electrolyte by means of zinc dust.—*Industries and Iron,* No. 30; abstracted in *Elektrochem. Zeit.,* May 1.

Dumoulin Copper Process.—A brief illustrated description of the plant at Widnes, in England, where this process is used.—Kershaw. *Elektrochem. Zeit.,* May 1.

Organic Electrochemistry.—A supplementary article to those by that author; he discusses electrolysis by means of alternating currents.—Kruger. *Elektrochem. Zeit.,* May 1.

E. M. F. and Thermo-Chemical Data of Cells.—A continuation and apparently the conclusion of his series of articles.—Platner. *Elektrochem. Zeit.,* May 1.

Calcium Carbide.—A short article on the crushing of the raw material in which it is maintained that a better result is obtained by using coarse, raw material instead of finely pulverizing it.—Lond. *Elec.,* May 19.

Switchboard for Electrolytic Analyses.—An illustrated description of a laboratory switchboard for greater convenience in making electrolytic analyses.—Riban. *L'Eclairage Elec.,* May 13.

Galvanic Polarization.—An abstract of an article describing investigations on the polarization of a cell and the energy required for the decomposition.—Jahn. *Zeit. Phys. Chem.* 26, p. 385; abstracted in Lond. *Elec. Rev.,* May 12.

Victoria Accumulator.—Further data and reports of tests are published in the Lon. *Elec. Rev.,* May 12.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring the Insulation Resistance of a Battery of Accumulators.—In a short paper by Mr. Liebenow, reprinted in the *Elek Zeit.,* May 18, he describes briefly and gives the theory of a method of measuring the total insulation resistance of a battery of accumulators. Formerly such a measurement presupposed that there was only one point of leakage in the whole battery, and to measure this a voltmeter of known resistance was connected first between the earth and one pole, and then between the earth and the other pole, and from the two deflections and the resistance of the voltmeter, the resistance of the fault can be calculated on the assumption that there is only one. This method fails, however, when there is more than one, or if there are a great many small faults. His method is intended to meet that case. It is assumed that the internal resistance of the accumulator is negligibly small as compared with the resistances of the faults; the battery can therefore be assumed to be a conductor without resistance and made up of a large number of e. m. fs. in series and that there are a large number of leaks at different points. It is understood that the battery must be disconnected from the circuit before any measurements are made, or otherwise the insulation resistance of the circuit would be included. An amperemeter is connected between the earth and one of the poles and the current is measured; the same is then done for the other pole; then the insulation resistance is equal to the e. m. f. of the battery divided by the sum of these two currents, irrespective of their signs, that is, their numerical and not their algebraic sum; a proof of this formula is given. It is applicable chiefly to comparatively low insulation resistances. When greater accuracy is required or when the insulation resistance is very high, an amperemeter of higher resistance must be used; by the previous method the value of the total insulation resistance would be too great; this can be overcome with the aid of a small auxiliary battery which is so connected between the instrument and the main battery that the voltages of both are added to each other; this auxiliary battery must be carefully insulated from the earth and the measurements as above described are then made. If the internal resistance of this auxiliary battery is also small, then the sum of the insulation resistance and that of the galvanometer is equal to the voltage of the main battery added to twice the voltage of the auxiliary one, this sum being divided by the sum of the currents, as before. It is necessary to see to it that twice the voltage of the small battery is greater than the sum of the two currents multiplied by the resistance of the galvanometer. If the resistance of the auxiliary battery cannot be neglected its value will form part of the resistance thus calculated and must be subtracted from it. If this internal resistance as well as that of the galvanometer are not known, then the measurement may be made with the aid of an additional galvanometer for simply indicating a zero current as in a Wheatstone bridge. This auxiliary galvanometer is connected between the earth and the junction of the auxiliary and the main battery, the other connections being as heretofore, except that an adjustable resistance is placed in series with the amperemeter sufficient to reduce the current in the other instrument to zero. This is repeated for the other pole of the battery and the insulation resistance is then equal to the voltage of the main battery divided by the sum of the two currents, as in the first described test. This method enables the measurements to be made with any desired accuracy. The auxiliary battery may be smaller, the larger the insulation of the main battery. In the discussion Prof. Wedding asked whether this method would apply if there was a low resistance fault or short circuit in the middle of the battery, as the currents flowing through this would then not pass through the amperemeter (presumably he referred to the case of two faults in the middle of the battery). The author explained that when there is a cross connection between cells, without passing through the earth, his method will not measure it, but when there are several low resistance faults

through the earth, then all the currents will pass through his measuring instrument if in the first method the resistance of the amperemeter is small enough, or in the second case, if the auxiliary battery is large enough to bring the other galvanometer to zero. With very bad faults, connecting one pole of the battery to earth would produce such strong currents as to destroy the instrument, and it is therefore well to make a trial test first with a fuse; if there is such a dead short circuit a sensitive method of measuring is of course unnecessary.—Liebenow. *Elek. Zeit.* May 18.

Quadrant Electrometer for Alternating Currents.—A brief abstract of a Physical Society paper describing an instrument devised by the author. He substituted two sets of flat plates for the cylindrical quadrants, the top set being adjustable, thus increasing the range of the instrument considerably and enabling the "electrical zero" to be obtained; the sensitiveness is about 12 times as great as that of the usual instruments.—Addenbrooke. Lond. *Elec. Rev.*, May 19.

Measurements of High Resistances.—A description of a method consisting in determining the damping of oscillations of a d'Arsonval galvanometer on open circuit, and again when short-circuited by the unknown resistance. From 4800 to 800,000 ohms can thus be measured with an accuracy of 1 per cent.; specific resistances of electrolytes can also be determined in this way.—Schuerr. *Jour. de Physique* 7, p. 598; noticed briefly in *Science Abstracts*, April.

REFERENCES.

National Physical Laboratory.—The Lond. *Elec.*, May 19, publishes the scheme of organization drawn up by the Royal Society, for the government of the proposed national physical laboratory of that country. The constitution of the general board is given and contains the names of Alexander Siemens, Ayrton and Preece; Lord Rayleigh is vice-chairman of the general board. Parliament is to be asked for a grant of $60,000 for the buildings and an annual grant of $20,000. The resources of the Kew Committee of the Royal Society and the buildings used by them will also be handed over to the new institution.—Lond. *Elec.*, May 19.

Improved Dipping Needle.—A reprint of a short paper describing a new form of dipping needle devised by the author to be used in making magnetic surveys for discovering iron ore; he claims that it is more sensitive and reliable than the Swedish prospectors' compass and is less cumbersome than the magnetometer. It is a combination of the best points of the Swedish and American dip compasses.—Louis. Lond. *Elec.*, May 19.

Measurements of Magnetic Qualities of Iron.—The conclusion of his very long article which is intended for the manufacturers of iron and shows how the necessary tests may be made to determine the magnetic qualities.—Schmidt. *Zeit. f. Elektrochemie*, March 4.

Induction Coil.—In the present continuation of his article (see Digest, May 13), he discusses the theory, the power and efficiency of the induction coil.—Armagnat. *L'Eclairage Elec.*, May 29.

Submarine Cable Faults.—A brief discussion of the recent article by Murphy (see Digest, May 20).—Jona. Lond. *Elec.*, May 12.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Absorption and Cable Speeds.—Brief contributed discussions to the recent paper by Young. Mr. Shuter, of a cable construction company, criticises very unfavorably the recent statements of Siemens (see Digest last week), concerning the speed of the cables made by the latter's company; it is claimed that the figures are unreliable and misleading.—Sullivan suggests that the absorption in cables may be due to electrolysis by the charging current in decomposing the minute traces of mositure contained in the insulating material; a more complete extraction of this moisture in the course of preparation may tend to reduce the absorptive power.—Attention is also called by Mr. Bright to the great importance of the question of reducing the absorption in cables.—Lond. *Elec.*, May 19.

A communicated discussion by Dearlove is reprinted in the\Lond. *Elec.*, May 19.

Government Telephone Proposals.—The conditions under which the British government proposes to grant local authorities licenses to establish telephone exchanges are reprinted in full and discussed editorially; it is thought that if carried through during the next 11 years, it will impede the progress of telephony in that country more than ever.—Lond. *Elec.*, May 19.

Submarine Telegraph.—The beginning of an abstract of a recent communication to the Royal Society of Edinburgh on the survey of the route between Bermuda and Jamaica, made in 1897.—Peake and Murray. Lond. *Elec. Rev.*, May 19.

Telephony in Switzerland.—Abstracts of some statistical information for 1898.—Lond. *Elec.*, May 12.

Telephone Testing Switchboard.—A brief illustrated description of the one used in the Paris installations, by those who repair the telephones.—*L'Eclairage Elec.*, May 13.

Automatic Block Signals.—An illustrated description of a system for single track electric railways which has been in successful operation for six months in Massachusetts.—*Eng. News*, May 25.

Speed of Transatlantic Cables.—A reprint of a statement giving the estimated and actual speeds of transatlantic cables; it was presented in the discussion of Young's paper by Mr. Siemens, and it shows that the actual speeds obtained by the cables made by Siemens Brothers are very much greater than they calculated.—Lond. *Elec.*, May 12.

New Books.

HANDBUCH DER TELEPHONIE. Nach dem Manuscript des Dr. Victor Wietlisbach. Bearbeitet von Dr. Robert Weber. Wein: A. Hartleben. 368 pages, 372 illustrations. Price, 10 marks.

This handbook of telephony is a compilation of carefully selected notes by the Director of the Swiss telephone systems, Dr. Victor Wietlisbach, who unfortunately died before the matter was ready for the press, and the work has been completed by Prof. Dr. Robert Weber.

We are gratified to see the prominence given in the book to American systems and apparatus; in fact, were one not reminded by the language employed that it is a foreign publication, it might be taken for an American treatise. The author divides the subject into five main parts, dealing respectively with telephone apparatus, the exchange, the line, long-distance telephony and long-distance apparatus and exchange work. While sufficient mathematics is employed throughout the work to explain the different phenomena of sound production and propagation, the author has seen fit to reserve the high mathematical demonstrations for an appendix consisting of six chapters and having reference to the various portions of the text.

The apparatus and systems described are nearly all in practical use at the present time, either in this country or abroad, and many novel and highly commendable methods are employed for describing and illustrating the various phonetic phenomena. If there is any criticism to be made from the standpoint of an American reader, it is on the chapter relating to line construction, which refers nearly in its entirety to foreign practice. This, however, can hardly be termed a fault in a foreign publication, and we can say without hesitation that this book is the most up-to-date and complete work on telephony.

BOOK RECEIVED.

THE STEAM INDICATOR AND ITS APPLIANCES. By William Houghtaling. Bridgeport, Conn.: The American Industrial Publishing Company. 307 pages, 157 diagrams. Price, $2.00.

.....At the.....

Electrical Exhibition

Close of the Show.

The last week of the Electrical Exhibition at Madison Square Garden was marked by hot weather and a very heavy attendance. There were several events during the week including Decoration Day on Tuesday, another liquid air lecture on Friday by Mr. Tripler, and the annual meeting of the New York Electrical Society on Saturday, with a lecture by Mr. W. J. Clark on wireless telegraphy and telephony.

The voting for the pretty Riker electric automobile to be given to the most popular actress was closed on Saturday night, when Miss Maude Adams was declared the winner with 14,764 votes. Next to her came Lillian Russell with 13,615 and Mrs. Leslie Carter was third with 8994. The style of vehicle devised for the contest has caught the popular fancy, and many others like it were ordered before the show closed.

Inquiries among the exhibitors elicited very general admissions of satisfaction as to the commercial results. The automobile concerns certainly could have no cause for complaint, and they report not only frequent orders but inquiries that will lead to a large amount of business. The dynamo and motor builders, the supply concerns, and

houses making specialties were all recipients of close attention and much patronage from the public.

The managers of the exhibition also were well satisfied with the results of their labors, and with the demonstration afforded of the keen desire of so many people to see and hear what is latest in electricity. President Baker said that the attendance and general results exceeded his anticipations, and that in many ways the show had done much to make up for the unavoidable disappointments of the exhibition in 1898, when the war with Spain broke out and when nothing was thought of but that event. General Manager Nathan, whose work had been done as usual with the utmost fidelity, courtesy and intelligence, was presented with a massive silver loving cup by the exhibitors, with a suitable inscription, and he was also the recipient of some handsome cut glass. Speaking for the National Electric Light Association, Secretary Porter said that the members had been delighted with the courtesies and attention shown them, and that, thanks to the exhibition, the meeting had been one of the best in many years.

Appert Glass Co's Exhibit.

At the Madison Avenue entrance, on the south side, the Appert Glass Co., of 141 Broadway, New York, had an exhibit which in its way was as novel as anything in the Garden, and which was in curious contrast to a cut-glass exhibit made in a corresponding space just across the aisle. This glass is made under the patents of Leon Appert, and is already in large use in Europe. It is molded in such a manner as to permit the production of very large articles with uniform thickness, which are perfectly annealed. The glass is not only remarkably strong, in the mechanical sense, but is absolutely resistant to acids and to high voltage currents. The exhibit included Appert specialties in pipe, jar, sheet, tiling, plates, etc., and embraced many novelties. The company has, for example, glass pipe of an inside diameter of 4 inches with a quarter-inch wall. It withstands currents of 35,000 volts when dry and 20,000 when wet. Such glass made up into jars is an ideal substance for storage batteries. The surface is ribbed, and smooth panels allow inspection or graduation and can be drilled.

In addition to this glass, which must command a large market of its own, the Appert Company has also the control of an extraordinary novelty in the shape of glass paving, some of which is already in practical use in France. There is little doubt that this tough conglomerate glass will take a leading place in the paving of the future. It is also made up into special shapes for decorative work, just like terra cotta, and bids fair to retain its keen edge through centuries.

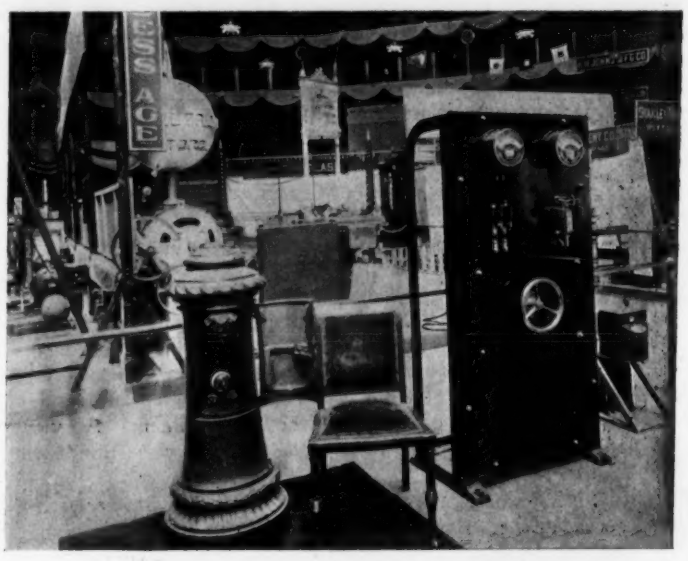
Attractive Electrical Novelties.

One of the centres of popular attraction at the exhibition was the display of the American Electrical Novelty & Manufacturing Company, of 255 Centre Street, New York. There were exhibited very extensive and varied lines of goods at once useful, practical, economical and ornamental. The emergency search, or flash light seemed to be one of the most popular articles shown. This light is in the form of a long cylinder, at one end of which the lamp is placed behind a lens. By pressing a ring on the outside of the case, while holding it in the hand, the circuit is closed and the rays of light shine from the end of the tube. The battery is contained within the cylinder. These lamps are made in three sizes, the smallest being intended to carry in the pocket. It is stated that from "6000 to 8000 lights" can be obtained before the battery requires renewal. Another novelty which attracted attention was the "Ever Ready" electric walking cane. The lamp is similar to the one just described, but made so as to form the top part of a walking stick. This cane is said to be of great assistance in locating the position of key holes, and finding house numbers at night.

Many other novelties were displayed, including the interior searchlight, which is made for the examination of interiors and use in locations inaccessible by ordinary lights; "Ever Ready" gas lighters; surgical and dental lamps; "Ever Ready" electric bicycle lamps; "Ever Ready" night lights for small clock or watch; "Ever Ready" electric candles; banquet lamps; "Ever Ready" electric ruby lamps for amateur photographers; "Ever Ready" electric reading lamps; electric scarf pins, etc., etc. The success of all of these articles is due largely to the "Ever Ready" dry battery manufactured by this company. This battery is made in a great variety of forms to suit the particular conditions to which they are applied. An important feature of the different articles is that each one is self-contained and complete—no batteries or wires being visible.

Automobile Charging Hydrant.

For some time past, the desirability of having facilities for nickel-in-the-slot charging around the streets of cities has been under consideration, and one of the plans proposed for adoption is shown in the cut herewith, which illustrates the "hydrant," as it is called, designed by Mr. John Van Vleck, of the Edison Electric Illuminating Company, of New York. The post was shown in the space of the Columbia Automobile Company at the Garden. Completed, it contains an ammeter, suitable safety fuses, controlling and regulating switches and a prepayment recording meter—with, perhaps, a voltmeter, if its practical utility is proved. To obtain a charge, either money or a numbered check is deposited in the slot.



VAN VLECK CHARGING HYDRANT.

This will either establish the connections and start the meter, or will open the door permitting access to the controlling switch. It is intended that these "hydrant" posts shall contain two or three outlets with meters, at the more important vehicle stands, etc., to enable a carriage to obtain a charge with the greatest facility. Much of the success of the system depends obviously upon the practicability of the prepayment meter.

The charging board shown can be installed at any point in connection with regular Edison service, and arrangements are now being carried out to equip a number of stables located in different parts of the city. Vehicles coming downtown in New York can now renew their charge at the Edison Duane Street Station.

The Early Edison Electric Locomotive.

It has been pretty generally known that Mr. T. A. Edison worked on electric locomotives some twenty years ago at his old Menlo Park laboratory, but the extent of his work has not been matter of public knowledge, and, in fact, the whole subject has been more or less misty. It was therefore very interesting to see at the Garden during the last ten days of the show. Mr. Edison's locomotive of 1880-1, in very bad and battered condition it is true, but still in actual evidence, with one of his long-waisted generators used as a motor. It was regarded with great curiosity by the visitors. Elsewhere in these pages this week will be found a succinct history of its career and of Mr. Edison's early railway work, by Mr. E. W. Hammer, who has been good enough to compile what has hitherto been an unwritten chapter in the art. It may be added that the remains of two or three other Edison locomotives still litter the meadows at Menlo Park like the fragments of extinct monsters of an electrical paleozoic period.

The New Standard Dry Batteries at the Show.

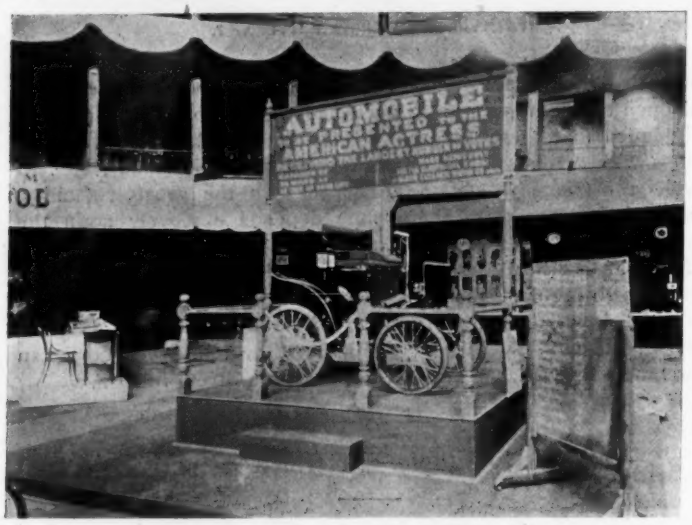
In connection with the exhibit of the H. E. Pfass Electrical Construction & Supply Company was a full line of the New Standard dry batteries, manufactured by Mr. William Roche, 42 Vesey Street, New York. These cells have attained much prominence through their extensive use on board of United States warships during the recent war with Spain. There were exhibited all sizes, from the large "Navy" cell down to the smallest pocket cell. The latter is especially adapted for use in connection with electric scarf pins, and like novelties, which lines have been added by Mr. Roche to his already large business. He reports that the demand for his batteries is world-wide, and rapidly increasing.

Color Printing Presses.

One of the most interesting and instructive exhibits of the application of electric power was that made by the John Thomson Press Co. and the New York Colortype Co., both of this city. Three of the well-known John Thomson Colt Armory presses were in operation, driven by Crocker-Wheeler motors, and upon them were printed a number of subjects in color, illustrative of the three-color process of printing. The exhibit included also a large number of specimens of work turned out by this method, and the whole was found very attractive by a large crowd. The necessary accuracy of registration, evenness of running and regularity of the speed as evidenced in the work, were a remarkable proof alike of the success of the process on fine presses and of the ability of electric motors to furnish exactly the driving power required under all the exacting conditions.

The Prize Automobile.

Note is made elsewhere of the results of the voting as to which "popular actress" should be lucky enough to receive the electric automobile offered by the management. A view of the carriage is here given. It was built specially by the Riker Electric Motor Company, and is of the dog cart type. It is trimmed in English hunting scarlet, with running gear picked out in vermilion, and with handles, etc., in silver and nickel. Its rear axle is equipped



THE PRIZE AUTOMOBILE.

with two motors of three-quarter kw each, and the battery consists of 24 cells of 60 ampere hour capacity. The steering is effected by the front wheels. The carriage has an ability to run 20 miles, and it weighs only 1,100 pounds complete. It attracted a great deal of attention, and the style is such as to lead one to believe that duplications of it will prove both popular and numerous in the near future.

Electricity in the Diving Tank.

It would be difficult to get together a better demonstration of the uses of electricity under water than was given at Madison Square Garden by Capt. Sorcho and his wife, under the management of Mr. Postley. A very large tank with plate glass front had been erected in the basement so that several hundred people at once could watch what was going on in the tank, into which water to a depth of over eight feet was pumped daily after being filtered to render it clear. Capt. Sorcho is one of the most successful divers in this country and has made many inventions in that department, but the diving at the garden was all done by his wife, who went through a long series of demonstrations very skilfully. Her diver's rig was donned in full view of the audience, while Capt. Sorcho gave a shrewd, plain, practical description of the diver's life and work. Mrs. Sorcho then decended into the water among the fish, turtles, etc., and illustrated the use of life lines, air lines, recovery of valu-

Electricity Applied to Submarine Work
By CAPT. LOUIS SORCHO and CORPS of EXPERT DIVERS.
CHAMPION HYDRAULIC
AIR COMPRESSOR

THE DIVING TANK.

ables and dead bodies, and the methods of dealing with various conditions. Her helmet was equipped with the Sorcho submarine telephone and she was able, while under water, to maintain constant commication with her husband and with any member of the audience who wanted to talk to her Another illustration was the use of an incandescent searchlight under water, which she wielded very cleverly; and a demonstration was also given of the way in which submarine mines and dynamite charges are fired electrically by divers. A novel feature of the exhibit was the burning under water for several minutes at a time of an enclosed arc lamp built by Mr. G. R. McIntire The exhibit also included a section of the Safety submarine cable built for the United States Government to be laid in the Philippines. Altogether, Capt. Sorcho gave an hour's amusement of the most interesting and entertaining kind, and the show deserved the big crowds that it drew all the time. During the last week, Capt. Sorcho broke the world's record for staying under water continuously, and remained there seven and a half hours, during which time he was in communication with the whole subscribers' list of the New York Telephone Company, and could thus be talked to even by another diver at the bottom of Lake Michigan, if one should happen to be there.

Exhibit of Lamp Cleaners and Manipulators.

The Incandescent Electric Light Manipulator Company, 116 Bedford Street, Boston, Mass., had an exhibit which attracted a great deal of attention on account of the utility of the device shown. This manipulator and cleaner has already been described and illustrated in these columns, but a brief reference to it in this connection will be appropriate. Its object is to remove and replace incandescent lamps in situations which are usually inaccessible. It consists of a long rod, or handle, at the end of which are two jaws which are controlled from the base of the handle. The jaws are lined with rubber and take a firm grip on the lamp bulb. By turning the handle and with it the nippers or jaws, the lamp may be detached or attached according to the direction of the motion. With the nippers is provided a glove-like covering, which, in revolving, cleans the lamp bulbs. The manipulator and cleaner can be operated at any angle. The device is made up in sizes for lamps ranging from 2 to 64-cp. A special machine is made for street lighting. It is somewhat plainer than the

type referred to, and has a straight rod, not being provided with the flexible connection which permits of operation at an angle. The benefits derivable from the use of this device are decidedly important, especially in large halls where the lamps are ordinarily difficult of access. By cleaning the exterior surface of the bulbs the full amount of light can be obtained from the lamps. These manipulators are particularly adapted for use in depots, steamboats, street cars, public halls, hotels, stores, theatres, churches, etc., and are now in regular use in many places in the United States and in foreign countries, where they are giving uniform satisfaction. The exhibit is looked after by Mr. Frank W. Morse, treasurer of the company.

Electrolytic Generators and Their Work.

Those looking for an argument to uphold a theory that electrici y forms the connecting link which joins and holds together the component parts of every object in nature, might be referred to the growing electrolytic branch of electrical work. By means of electricity the gases oxygen and hydrogen unite to take the form of water, and a reversal of the process removes the link and resolves the water into its constituents, oxygen and hydrogen. Similarly, the electrolytic process decomposes substances by the action of electricity, allowing the component parts to be separated and dealt with independently, or new combinations effected.

It is this diversity of application which has taxed the ingenuity of electri al engineers and manufacturers to provide machinery adapted to apply electrical power to these novel purposes. Every day brings its fresh demands. A visit to the plant of the Boston and Montana Copper and Silver Mining Company, Great Falls, Montana, will well repay any one interested in the electrolytic process. The street car from the city follows the course of the Missouri River, which lies in a deep gorge; the banks of reddish brown earth rising 250 feet on either side. On this soil, resembling adobe,

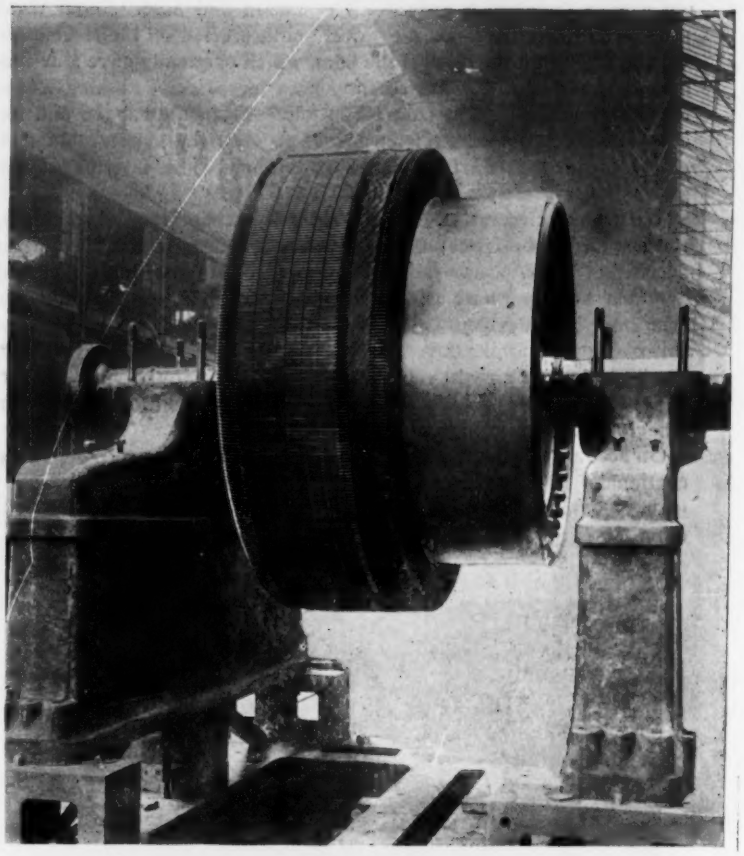


FIG. 2.—ARMATURE CORE OF GENERATOR.

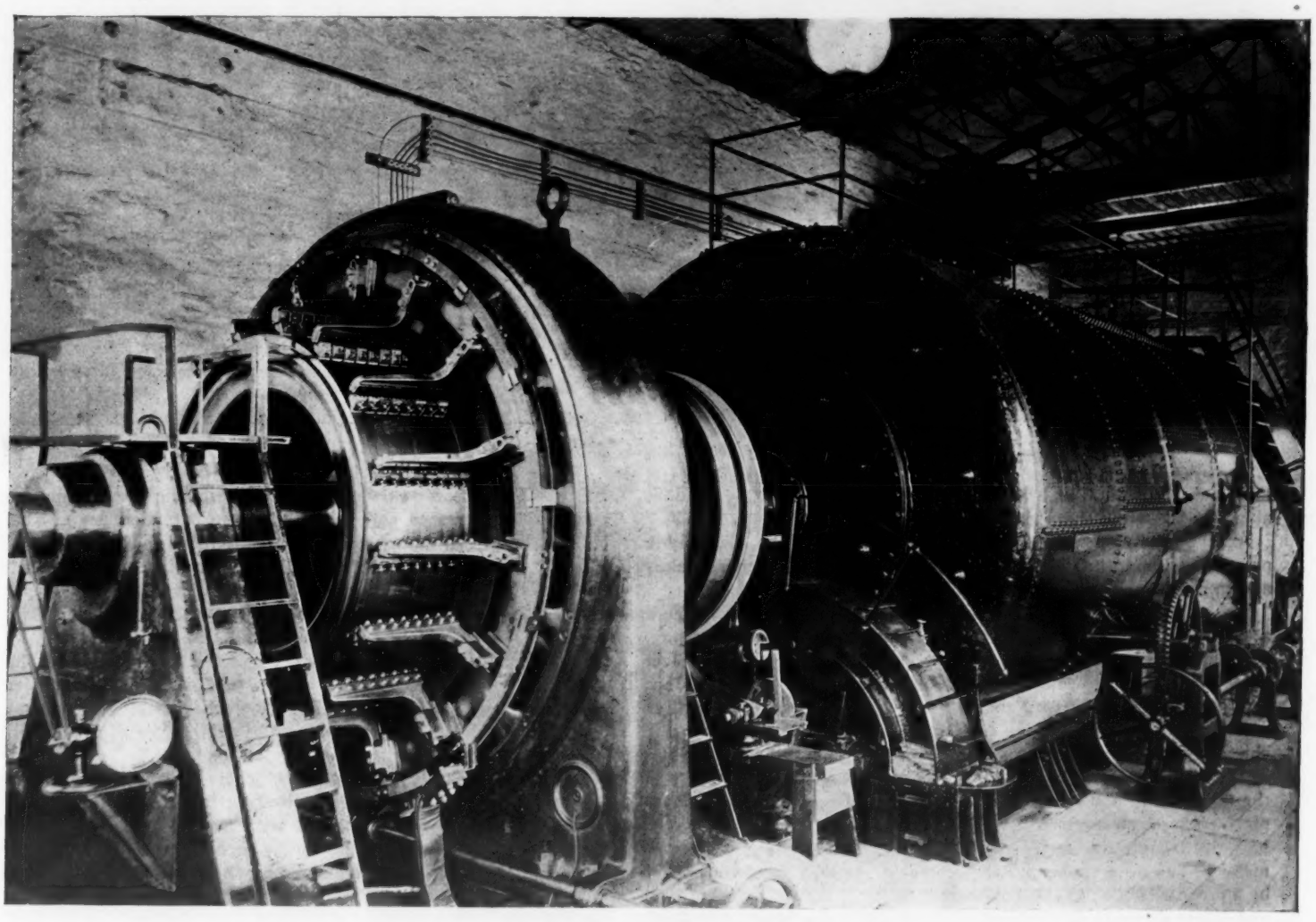


FIG. 1.—INTERIOR OF POWER HOUSE.

not even a sage brush grows—all is barren and bare. About three miles from the city stands the power plant, erected on the river bank. A little higher up the river is the dam, which originally gave a 42-foot head of water, but this has recently been increased. Passing within the power house a great contrast is felt. From the rugged and uncouth nature without, one step brings to view the massive but delicately finished product of man's invention. The interior of this power house is shown in Fig. 1.

Within the circular case at the right is a twin wheel, supplied by the Dayton Globe Iron Works. This is driven by water, developing 2900 hp at 130 r. p. m. Direct connected to the shaft, on either end, are two Westinghouse generators, each nominally of 810 kw, but guaranteed to develop 1210 kw. They are regularly operated at this overload, running seven days in the week, night and day. These machines have a normal rating of 4500 amperes at 180 volts, but are guaranteed to carry 5500 amperes at 220 volts continuously. The machines are run in multiple.

On account of the heavy electric current and its low voltage, an exceptionally large conductor had to be devised. This is of copper, 2 inches by 12 inches, and has the appearance of a continuous plank, extending from the power house to the works on the summit of the hill, a distance of half a mile. It is raised on rough scaffolding about 12 feet from the ground.

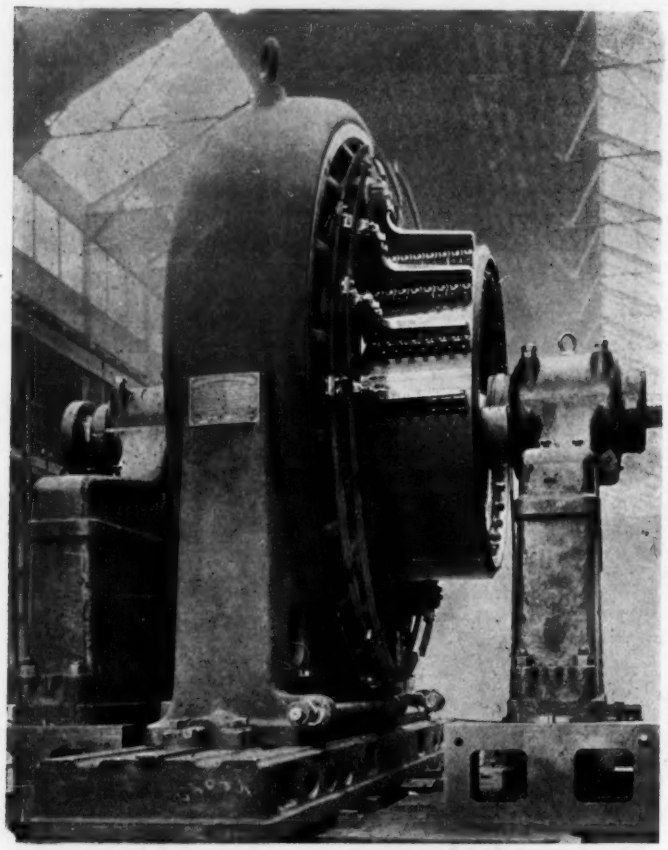


FIG. 3.—FIELD OF GENERATOR.

At the works the electric current is used for the electrolytic process applied to refining copper from its admixture of others metals and impurities.

The copper ore in its crude state is first ground and put through a concentrator to remove the refuse. This is followed by smelting, the metal being cast into pigs about 2 inches in thickness and 2 feet square, having two projecting shoulders at one end. The pigs are now ready to be subjected to the electrolytic process. A series of tanks are arranged side by side, filled with a solution consisting chiefly of copper sulphate. The pigs of metal are arranged in rows in the tanks, hanging by the shoulders on brackets on either side of the tank. A thin sheet of copper is placed between each pair of the pigs. The electric current, varying from 9000 to 11,000 amperes, is passed through the series of tanks, and decomposes the pigs of metal. The pure copper is transferred to the thin sheets of copper by a process similar to electroplating, and the residue containing gold and silver drops to the bottom of the tanks in the form of a slime. It is said that this slime is valued at $2500 a ton, the gold and silver extracted from it being sufficient to reimburse the whole cost of the refining process.

The annual report of the Boston and Montana Company for the year 1898 gives the sales of copper, gold and silver at nearly $7,500,000, and amount applicable to dividends, after payment of all expenses, $3,500,000.

Fig. 1 of the power house shows the Westinghouse generators direct-connected to the turbine. The field casting of each generator is divided vertically, opening upon ways in a horizontal direction. This vertical division affords excellent facility for inspection or removal of the armature or field coils without the necessity of removing the out-board bearings. This arrangement is of great convenience where head room is limited and cranes for handling heavy weights are not available.

The armature core, Fig. 2, is composed of punched steel discs,

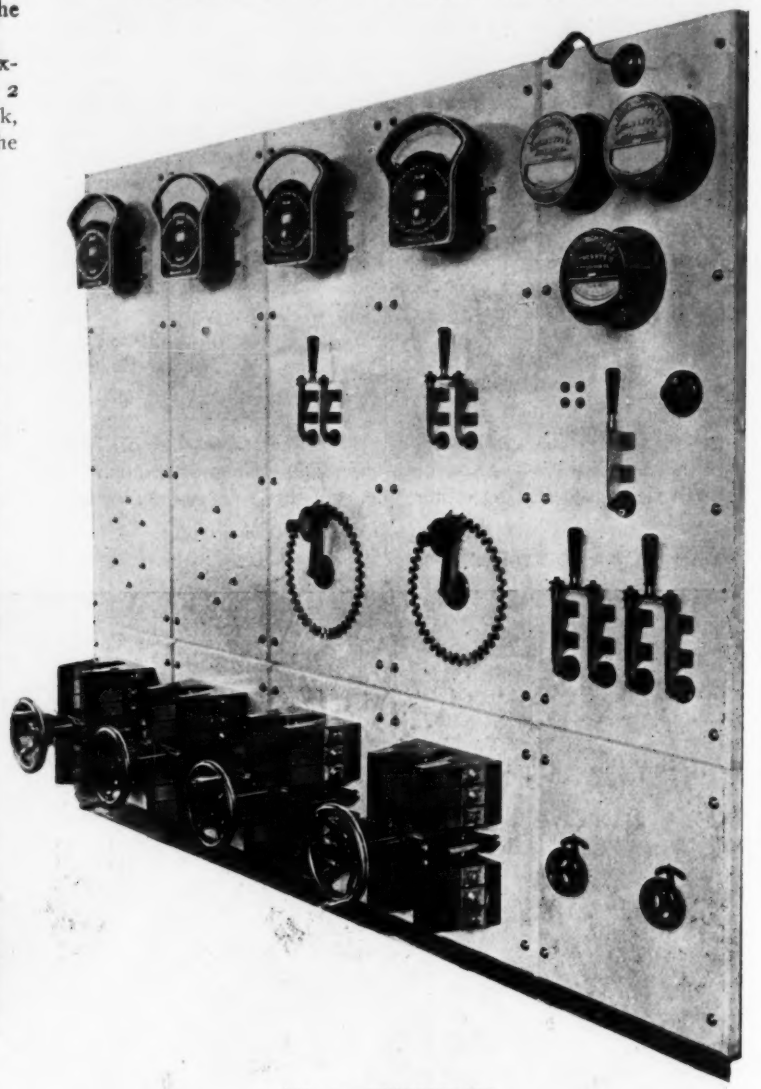


FIG. 4.—SWITCHBOARD.

and is built upon an iron spider, which also carries the commutator. This spider is pressed and keyed upon the extended engine shaft, and may be drawn off without in any way interfering with the permanent arrangement of the commutator and windings. The fields are separately excited, the current for this purpose being supplied from a 125-volt generator. Fig. 3 shows the completed field, with the brush holder in course of construction.

These Westinghouse generators are connected to the turbine shaft by a flexible coupling composed of two steel discs carrying projecting pins set at different radii. The coupling is effected by means of heavy links of leather, each link passing over a pair of pins, one on each disc.

The brush holders are carried by brackets projecting from a ring, concentric with and supported by, the field frame. By means of the hand wheel worm, which engages with a gear on the rim of this ring, adjustment of all the brushes is accomplished simultaneously. The ring carrying the brush holder brackets lies close to the field, and does not project over the commutator; the commutator and brushes are therefore clear of obstructions and may easily be inspected at any point.

Fig. 4 shows the switchboard built to control the two 810-kw Westinghouse generators. The instruments mounted on the right hand panel are used in connection with two 22½-kw, 125-volt exciters. The other four panels contain the necessary switches and instruments for controlling the two 810-kw generators. The board is 7 feet 6 inches in height and 10 feet long. The four single-pole switches mounted thereon are of 6000 amperes capacity each.

The Anaconda Copper Mining Company, at Anaconda, Mont., operates nine Westinghouse electrolytic generators. Three are belt-driven, at 360 r. p. m., each being of 270 kw, or 3600 amperes at 75 volts. Four other generators are direct connected at 180 r. p. m., each being of 270 kw, or 3600 amperes at 75 volts. The two direct-connected generators of 360 kw and three of 270 kw, unbelted, have a novel feature, in possessing two commutators, one mounted at each end of the armature. Two commutators are used on these machines on account of the large current generated by them. The two commutators provide sufficiently enlarged surface to carry off the current from the armature coils to the brushes, thus avoiding excessive heating. This arrangement of two commutators distributes the weights more evenly on the frame bearings, and secures better commutation through the firmer contact of the brushes. These generators are connected directly to the engines by means of flanges which are forged upon the shaft. The brush holders, which can all be adjusted simultaneously by a hand wheel, are supported from the field casting, the latter being divided horizontally.

The four 270-kw Westinghouse generators are direct-connected to the engines, the field castings resting upon the extended bed plate of the engine, as do the two out-board bearings supporting the armature. The brush holders are supported by a circular casting which is secured to the bearing. All the brushes can be shifted simultaneously.

Southwestern Gas, Electric Light and Street Railway Convention, Austin, Texas.

A report of the convention proceedings appeared in the ELECTRICAL WORLD AND ENGINEER of June 3.

Owing to the fact that the electric power plant of Austin was shut down for some time just prior to the date for holding the convention, many supply houses which had expected to give exhibits of their machinery in operation were compelled to abandon the idea, and as a result there were very few exhibits.

The Waco Electric Supply and Plumbing Company, of Waco, Texas, had a creditable exhibit.

The Western Electric Company of Chicago, was represented at the convention by Mr. J. S. Jackson.

Mr. J. L. Sale was on hand representing the Southwestern Electric Engineering and Construction Company, of Dallas.

The firm of Rice, Stix & Co., electrical supply house, of St. Louis, Mo., was represented at the convention by Mr. T. M. Wortham.

The Western Electrical Supply Company, of St. Louis, was represented by Mr. W. A. Dutton, who made himself very popular with the delegates.

Mr. E. H. Kaufmann, the southern representative of Thomas A. Edison, attended the convention and left when it was over for Mexico, where he will remain some time on business.

Mr. John C. Kinney, an electric supply man of San Antonio, Texas, was also present. Mr. Kinney is the inventor of a trolley crossing which is soon to be placed on the market by an Eastern manufacturer.

Mr. Frank Warren, of the Warren Electric Manufacturing Company, of Sandusky, Ohio, attended the convention and received much attention at the hands of the street railway and electric men present, who are familiar with the Warren apparatus, of which he is the inventor.

Mr. G. M. Willis, consulting electrical engineer, of London, England, was in attendance at the convention. He is on his way home from a tour of Mexico, which he made in the interest of an English syndicate which proposes to make some heavy investments in electrical lines in that country.

Mr. Harry L. Monroe, special agent of the General Electric Company, with headquarters at Dallas, Texas, was on hand and was warmly welcomed by his many friends. He is deeply interested in the work of the association, and the success of the convention was largely due to his efforts. He had expected to have a large exhibit, but his shipment of machinery was delayed.

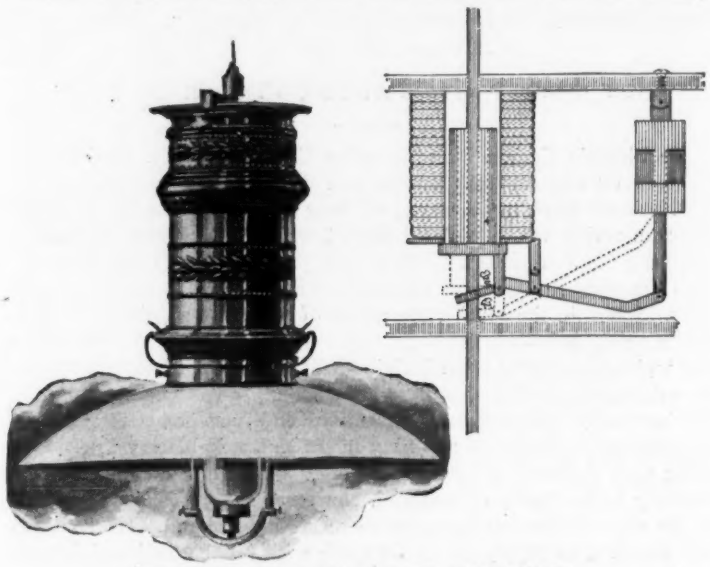
Mr. Herbert W. Smith, manager of the railway department of the Bibber-White Company, of Boston, Mass., was in charge of an extensive exhibit of street railway supplies and appliances. He took great pleasure in entertaining the visitors, and if he needs any one to swear as to the correctness of his expense account for champagne and cigars, he can call on almost any of the delegates present. Mr. Smith has been a business tour of the South for the past four months, and reports that he found business in the street railway line exceptionally good.

The Morris Enclosed Arc Lamp.

The tendency in arc lamp construction has of late taken a decided turn toward the use of the fewest parts possible consistent with reliable operation. The result of this has been the production of lamps that are models of simplicity in mechanical construction and electrical design.

The Morris enclosed arc lamp is one that has been evolved from these conditions. The carbon feeding device consists of a single solenoid or magnet, the core of which directly engages the carbon rod by means of a washer clutch. Any sudden movement of the carbon is checked by means of a self-lubricating dash-pot provided with a graphite plunger. These constitute all of the parts of the feeding mechanism, which, it will be thus understood, is free from clockwork, escapement or racks. The mechanism, although simple in the extreme, is said to control the arc in a very satisfactory manner.

These lamps are made for use on all standard constant potential circuits of 110, 220 and 550 volts. For use on 110-volt circuits they



THE MORRIS ARC LAMP AND ITS MECHANISM.

are connected in multiple, with about 80 volts at the arc. For 220 volts they are made for either multiple connection of two in series, and those for 550 volts are connected five in series. The light is said to be steady, with an absence of jumping when the voltage is even.

The accompanying illustrations show the feeding mechanism and a general view of the lamp, which is manufactured by the Morris Arc Lamp Company, Chester, Pa. The Manufacturers' & Inventors' Electric Company, New York, is the metropolitan agent for the Morris Company.

New Porcelain Insulator for High Potential Current.

The common form of porcelain insulators for sustaining interior line wires is that of a pillar having a perforation through its centre, through which a screw may be passed to secure it, a groove being provided near the top to receive and hold the wire. In such insulators the true insulation distance is not that from the wire to the base, but from the wire to some part of the screw. To obtain the highest insulating distance the diameter of the porcelain pillar should be more than twice the height of the wire from the base. This is, however, seldom realized, particularly in insulators employed in electric gas lighting work, where the potential of the current employed runs up from 25,000 volts, the spark being capable of jumping through an air space of from 1 to 1½ inches. In such work it is particularly necessary that insulators have as small a diameter as pos-

sible, for the sake of neatness. The mere lengthening of the body of the pillar affords no increase in the insulation resistance so long as the distance of the wire from the screw head remains the same.

Fig. 2 is a full size view of a new construction of porcelain insulator designed to overcome the disadvantages referred to, Fig. 1 being a sectional view of the same. The pillar is made hollow, the shoulder for the screw being located inside at its base. While the outside diameter is no larger than the smallest insulator that has

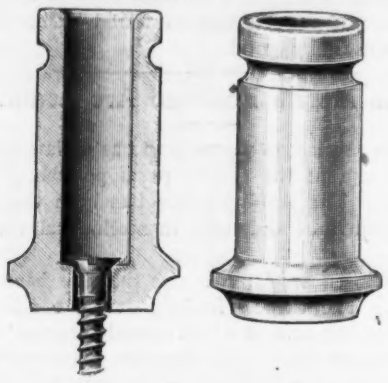


FIG. 1. FIG. 2.

been made, all parts of the screw are at a distance from the wire groove not less than 1¾ inches in any direction. Although the exterior presents a neat and unobtrusive appearance, it allows an ordinary screwdriver to pass into the tube to drive the screw.

These insulators have just been put on the market by the A. L. Bogart Company, 123 Liberty Street, New York City.

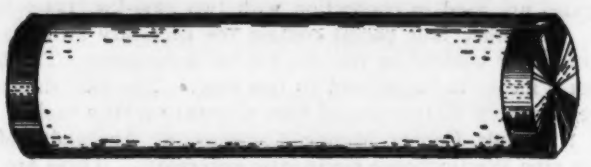
A New Battery Manufacturing Plant in St. Louis.

The Phoenix Carbon Manufacturing Company, of St. Louis, Mo., has sold its electric light carbon and motor brush departments to the National Carbon Company, of New Jersey. Immediately after this transaction was completed the Phoenix Battery Manufacturing Company was organized, with a full paid-up capital of $250,000. This company has just purchased a tract of land, of about eight acres, located in the southwestern part of St. Louis, adjoining the line of the Missouri Pacific Railway. It will at once begin the construction and equipment of what it claims will be the largest battery manufacturing plant in the world. This company owns valuable patents and has lately produced other inventions and lines of batteries which it claims are superior to anything in the galvanic battery line. The trade now demands a battery of higher grade in all respects, particularly as to quality of material, construction and efficiency, and it is the aim of the new company to meet this demand. Its facilities will enable it to supply the entire trade with reliable and satisfactory products.

The Phoenix Battery Manufacturing Company is composed of business men who have ample means and confidence in their ability to extend the business to greater proportions. From present indications the management thinks that the success and aim of the organization will be realized. Among the gentlemen interested in the enterprise is Col. S. G. Booker, who has for many years been prominently identified with battery-carbon manufacturing interests, and the new company is fortunate in securing the benefit of this gentleman's experience and knowledge, which will form a substantial foundation for the upbuilding of a large and progressive business.

Commutator Lubrication.

The sparkless operation of a dynamo depends largely upon the condition of the commutator and brushes, and a large proportion of dynamo troubles is traceable directly to lack of proper care of these parts. All rubbing surfaces require lubrication, and it is just as important that the commutator be properly lubricated as that a sufficient amount of the right quality of oil be supplied to the bearings. Brush friction forms a very appreciable part of the losses in a dynamo or motor, and is paid for at the coal pile or at the meter. A 10-hp multipolar motor recently tested showed, it is reported, a reduction of one-half in the current required to run it with the belt off after lubricating the commutator with Hare's commutator compound. This compound is a pure and simple lubricant, as carefully compounded as the highest grade of engine oil. It contains no pol-

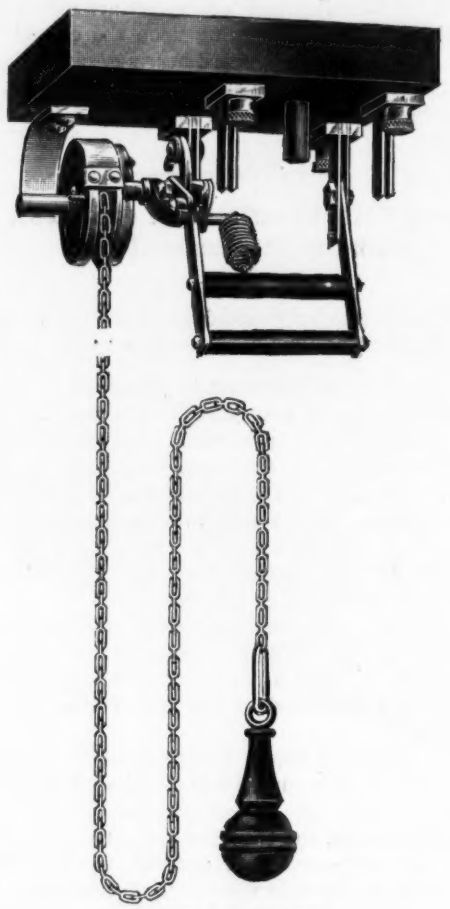


COMMUTATOR COMPOUND.

ishing powder or other injurious substance, and is guaranteed not to gum the brushes but to keep the commutator in perfect condition. It is manufactured by Southworth & Hare, Indianapolis, Ind.

A New Ceiling and Wall Switch.

Several contrivances have been devised for the purpose of controlling incandescent lights out of reach or inconvenient to reach. Some of these devices have been faulty in design and flimsy in construction, particularly those using a pendant cord or chain for operating, and requiring two or more pulleys and cords to run over them, the inevitable result being that the cords are generally off the pulleys and the two so entwined or tangled that it requires a period of experimenting before one discovers whether he is trying to turn the light on or off.



NEW FORM OF SWITCH.

The illustration shows a device for this purpose which is claimed to eliminate all trouble of this character, and has met with the approval of the National Board of Fire Underwriters. It consists of a double-pole knife, switch operated by a cam movement which does the work of opening and closing. The pull on the chain for either movement is always down; one pull turning the lights on, the next pull turning them off. The operation of the switch is extremely quick in either event, thus allowing no chance for drawing an arc. The operating mechanism is simple and no part of it is used as a conductor. These switches, which are mounted on slate bases, and can be placed either on side walls or ceilings, will be found a great convenience in show windows and other situations where lights are inaccessible. The J. Jones & Son's Co., 64 Cortlandt Street, New York, are the manufacturers.

NEWS OF THE WEEK.

Financial Intelligence.

THE METAL MARKET continues very strong, and there does not appear to be any prospect of copper below 18 cents. Current prices are around 18½ and the supply on hand, barely enough for an average month, does not increase. Heavy steel rail, Eastern mill, is quoted at $26 per ton. Lead is 4.45 cents. Throughout the iron and steel trade there is a scarcity and a prospect of further advances.

BELL TELEPHONE.—The importance of the telephone as a general indication of the state of business is shown by the recent figures of American Bell output. The first five months of 1899 show an output of over 200,000 instruments as compared with about 80,000 for the same period in 1898. The company's gross output in May was 55,302 and its orders were for 62,000. It is gradually catching up in capacity to meet the demand.

CHICAGO TELEPHONE.—It is proposed to authorize an increase of the capital stock of the Chicago Bell Telephone Company from $5,000,000 to $15,000,000 at the next annual meeting, the additional $10,000,000 to be issued from time to time as the directors may deem best. This proposition is simply in the way of looking forward to the steady growth of the business. In 1896 the company's engineers laid out a plan of extensions to accommodate 50,000 subscribers to be served from 22 stations. Twelve of those stations are now in use, and the company at the beginning of this year was operating 21,876 telephones.

WESTERN UNION WEAKNESS.—There does not appear to be any good reason why Western Union should drop to 88 last week. It is one of the very few stocks that has not advanced this year. There are rumors afloat that the dividend rate on smaller net earnings may decline from its present 5 per cent. to 4, but even at 4 per cent. the stock is worth much more than 88. New York Central on the same 4 per cent. basis is selling at 130. Western Union has paid dividends for a very long period, is firmly held by investors and after all is said and done has an enormous earning capacity.

WISCONSIN TELEPHONE.—Stockholders of the Wisconsin Telephone Company will hold a special meeting June 19 for the purpose of increasing the capital stock from $1,200,000 to $3,000,000. It is intended to use the new capital in extending the long distance lines to many points in the state not now reached, in the erection of new exchange buildings and in making other improvements. An energetic canvass for new business is also being made and the company will endeavor to increase the number of its subscribers to 25,000. Only copper lines will be built in extending the service. President Glidden says that the same policy will be followed in Michigan, where the most distant parts of the state will be brought into communication with Detroit.

HUDSON RIVER TELEPHONE.—The Hudson River Telephone Company, of Albany, N. Y., in which Boston and Lowell capitalists are interested, has just notified its stockholders through a circular issued by President Manning that the company's stock, now held for it in trust, will be offered at par to stockholders of record in the proportion of one share for each fourteen shares now held, excepting that the number of shares to be offered to the American Bell Telephone Company will be 222 shares, all told, the remainder of its proportion having been already issued to it, under the terms of the agreement existing between the two companies. Payment for the trust stock to be issued is to be made to the treasurer of the company on July 1, 1899, and such stock as is not subscribed for under the offer is to disposed of in such manner as the directors may deem expedient.

THIRD AVENUE RAILROAD FINANCES.—The Third Avenue Railroad Company, New York, will probably issue about $20,000,000 of new stock, as noted last week, to meet the expenses of the improvements that are now being made on the road. The capital stock of the company is now $12,000,000. It will probably be two or three weeks before the issue is made. Making the change of motive power from cable to electricity on the Third avenue road and those lines controlled by the company, it has been figured, will cost in the neighborhood of $10,000,000. To fund the debts of the Union Railroad, the Dry Dock and Battery and the Forty-second Street and St. Nicholas Avenue railroads a like amount will be needed. Thus far the Board of Directors of the Third Avenue company has not passed upon the plan for raising the money. After the Board has disposed of the matter the stockholders will have to approve it. The entire issue, it is expected, will be taken by the present stockholders, to whom the stock will be offered at par. This plan, if carried out, is considered preferable to issuing bonds for the $20,000,000. Mr. Edward Lauterbach believes that the stock will be taken by the present stockholders and that none will be offered to the outside public.

THE WEEK IN WALL STREET was one which witnessed a continual driving down in the prices of nearly all securities, partly on crop damage talk but chiefly as a liquidation after the recent speculative activity. As a matter of fact all the news was good news, but nothing could overcome the real or assumed depression of the market. This week things may be very different and there is a possibility of active conditions right up to the Fourth of July. During the week, 21,565 shares of Western Union were sold, dropping to 88, a loss of 4 points. General Electric, on the other hand, sold up ⅜ to 118⅜ on 4210 shares, and Metropolitan Street Railway gained 6½ up to 214½ on 48,916 shares. Brooklyn Rapid Transit sold off 1⅛ to 110¼ on 216,825 shares. In Boston, American Bell Telephone made practically few changes during the week around 335, and Boston Elevated declined 5 to 110. In Chicago, National Carbon pref. was steady at 80, and Chicago City Railway closed at 298. In Philadelphia, there was dullness and weakness, Electric Storage Battery selling at 155 asked and 145 bid. Philadelphia Traction was quoted at 98½, Electric Company of America at 16½; Pennsylvania Manufacturing Company at 23½. In the outside market in New York, electric specialties were weak. Electric Vehicle common closed at 109 bid, and New York Electric Vehicle Transportation at 22½ bid. Electric Boat common sold down to 18 bid, a loss of 6 points. General Carriage, which chiefly represents air power, closed at 44½ bid, a gain of 5½ points. What it has to show in actuality nobody seems to know. Its chief demonstration has been made with an imported electric carriage. National Gramophone was strong around 80 on payment of its twentieth monthly consecutive dividend at 1 per cent.

EFFECT OF THE FORD BILL.—The possible effect of the Ford franchise law in New York State is still a matter of active discussion. The capitalization of the Metropolitan Street Railway Company is substantially $29,000,000 bonds and $45,000,000 stock, of which $40,000,000 have been issued. These securities have a market value of something over $125,000,000. Manhattan Elevated has $48,000,000 of stock and $40,000,000 of bonds, with a market value of about $96,000,000. Brooklyn Rapid Transit has $45,000,000 stock, with a market value of over $50,000,000 and over $60,000,000 bonds, worth between $60,000,000 and $70,000,000, making a total value of about $120,000,000. If the market prices of the bonds and stocks represent the value of the property and franchises of these corporations, as they certainly must, they will probably be assessed as real estate is assessed in this city, by estimating as near as possible its fair market value and then deducting therefrom one-third of such valuation. If this theory of the basis of taxation is borne out by the assessors' action, taxes of Metropolitan Street Railway, instead of being $553,000, as last year, will be in excess of $1,600,000. Those of Manhattan, instead of the $365,000 paid (and the balance contested in court), something over $1,500,000; Brooklyn Rapid Transit, which paid a small taxation last year (the company reporting $6881, taxes for the seven months ending July 31, 1898) something in excess of $1,600,000. It will be seen that this increase in taxation seriously affects earnings for the stocks. Last year Metropolitan Street Railway earned on $30,000,000 of stock a little more than 6 per cent.; since then several of its trunk lines have been equipped with power, and earnings have increased so that 7 per cent. dividends are paid. But the statement for the March 31 quarter shows $507,551 earned for $40,000,000 stock, or 1.26 per cent., and for nine months to March 31, $1,786,669, or 4.46 per cent., against $1,344,744 last year, equal to 4.46 per cent. on $30,000,000 capital.

THE STATE OF TRADE.—Discussing the situation, Bradstreet's says: Holiday observances and warmer weather have worked toward a smaller aggregate of speculative transactions and less pronounced activity in some lines of wholesale trade this week, while naturally stimulating retail business at most centers, a point which is full of interest to wholesalers in view of possible reassorting demand and new business for fall account. Current bank clearings reflect the former influences in considerably reduced totals for the week, while cheerful advices as to trade in May as a whole are confirmed by very large bank returns for that month, second only in fact to the monthly totals of January and March, the latter holding the record in this respect. The favorable effect of the immense current industrial activity and consumptive demand offsetting the smaller tonage of cereals now as compared with a year ago is found in the continued good increases in gross railroad earnings. Net returns are, it is true, not quite so relatively favorable, but it is to be recalled that comparisons now are with specially good reports a year ago. In industrial lines the demand for and strength of iron and steel are the most interesting features. Business failures are down to a low summer minimum, numbering only 129, against 158 last week, 178 in this week a year ago, 192 in 1897, 236 in 1896 and 1895. Bank clearings for the week, covering practically the last week in May and including one holiday at most cities and two holidays at some, aggregate $1,377,994,000 a decrease of 27 per cent. from last week, but a gain of 19 per cent. over this week a year ago. For the month of May bank clearings at 74 cities aggregate $8,313,375,478, a decrease of 4.4 per cent. from the record total in March, but an increase of 56 per cent. over May a year ago, of 100 per cent. over 1897, of 114 per cent. over 1894 and of 65.7 per cent. over May, 1892. Only 9 out of 81 cities, making comparisons with May a year ago, show decreases, the most notable being in the northwest and on the Pacific coast. Heavy gains of large cities, too, are a feature not confied to any one section. For the five-months' period bank clearings are the heaviest there is any record of, aggregating at 77 cities $40,713,060,260, an increase of 48 per cent. over 1888, of 98 per cent. over 1897 and of 55 per cent. over 1892. Gains are heaviest in the middle states, New England and at the south, and are smallest in the far west and in the southwest.

Special Correspondence.

NEW YORK NOTES.

STREET RAILWAY SPRINKLERS.—It is stated that electric sprinkling cars will soon be introduced on the street railway lines in this city. It is the opinion of railway men that this method of sprinkling could be operated in New York at a fraction of the present expense of watering the streets. It is simple, rapid and complete. The method now in vogue in Baltimore is being considered. In the Baltimore watering car the water is sprinkled with a rotary motion toward the nearest curb, completely covering the space between the track and the sidewalk with an even film of moisture. When one side of the street is thus sprinkled, the car reverses its direction and sprinkles the other side.

COLONEL JOHN JACOB ASTOR, who arrived in this city from Europe a few days ago, in the course of an interview after landing, stated that the Spanish-American war had given this country a great deal of advertising abroad which is redounding to its interest. "Everything abroad is American now," Colonel Astor stated. "The manufacturers here of electrical and mechanical devices, machinery and the like," he continued, "are going to be overrun with orders from the Continent. Everywhere I went I was asked about the accomplishments of the United States in the line of invention and development." Colonel Astor is conservative in his statements, therefore his remarks above quoted are full of significance to those who will listen.

AN AUTOMOBILE CLUB.—Steps have been taken by several gentlemen who are owner of pleasure automobiles to organize a club. Among the active projectors in the enterprise are Messrs. Whitney Lyon, E. H. Lyon and G. F. Chamberlin, the latter a lawyer, at 31 Nassau Street. Mr. Chamberlin estimates that the club will be able to show a membership of between 75 and 100 persons this year, with prospects of largely increasing it as the use of automobile vehicles increases. The plan is to have a club house where men interested in this form of pleasure vehicles, can meet and plan excursions and parades. One of the features of the clubhouse will be the facilities provided for storing and caring for the automobiles. It will be the headquarters for the vehicles as well as for their owners.

ELECTRIC POWER ON THE BROADWAY AND OTHER NEW YORK CABLE LINES.—President H. H. Vreeland, of the Metropolitan Street Railway Company, is reported to have said that the work of changing the Broadway, Lexington Avenue and Columbus Avenue cable lines to the electric conduit system would be commenced this summer and rapidly carried forward, and that all three of these lines would be operated by electric power before winter. The company is waiting for the completion of its new power house at 96th Street and East River. At the present time the engines are in place, but the generators have not yet been delivered. The present power is supplied by the 26th and 146th Street stations, but is barely enough to operate the lines already equipped on the electric system. The only other contingency which keeps the company waiting is the preparations by its engineers of plans to enable both cable and electric cars to be run on the lines at the same time while the new system is being actually installed. This is quite a problem, Mr. Vreeland stated, but a general plan has been worked out by Engineers Pearson and Starrett and the details are now being elaborated.

PHILADELPHIA NOTES.

THE ELECTRIC STORAGE BATTERY COMPANY, on June 1, moved its general offices to its new factory building at Nineteenth Street and Allegheny Avenue, Philadelphia.

MR. H. C. ROBERTS, of the H. C. Roberts Electric Supply Company, Philadelphia, reports an excellent demand for ceiling fans. Although the hot weather has not yet opened up he anticipates a larger fan season than any of its predecessors.

MR. STEPHEN D. MORRIS, manager of Priestman & Co., Philadelphia Bourse, says that he received orders during the past two weeks aggregating 75-hp in gas engines in sizes ranging from 5 to 30-hp. The excellent regulation of his engines merits the attention of the electric light fraternity.

MR. W. D. BARNARD, president of the Eastern Electrical Construction Company, Philadelphia, says that he has in the past few weeks closed several large orders for the complete equipment of telephone exchanges in the State of Pennsylvania. He says that the indications for telephone business in the East during 1899 are excellent.

WESTERN NEW YORK NOTES.

THE HAMBURG RAILWAY COMPANY has secured a franchise in West Seneca. The contest for the franchise was spirited between the company referred to, the International Traction Company, and the Ridge Road & Lake Shore Railroad Company.

THE PAN AMERICAN EXPOSITION.—The preliminary prospectus of the Pan American Exposition, to be held on the Niagara frontier in 1901, has been issued. "This age of electricity," it says, "will be signalized for the first time at an international exposition by the exclusive use of electrical power, which will be generated by the energy of that great cataract, carried over cables to the exposition grounds."

MR. R. B. MELLON, of T. Mellon & Sons, bankers, of Pittsburg, Pa., is the successor of the late Captain Alfred E. Hunt as president of the Pittsburg Reduction Company. Mr. Arthur V. Davis, of Pittsburg, is the general manager of the company, and since Captain Hunt's death new responsibilities have fallen to him. Mr. Charles M. Hall, the inventor of the process for making aluminum, and Mr. William S. Ferguson are in charge of the Niagara plants.

THE NIAGARA FALLS & LEWISTON RAILWAY, better known as the Gorge road of Niagara, was sold by the sheriff of Niagara County in Lockport, May 23. The purchaser was Mr. Herbert P. Bissell, of Buffalo, who bid $6184, the amount he had advanced to Receiver Godfrey Morgan for rebuilding the road. The sale was subject to the $1,000,000 mortgage held by the Knickerbocker Trust Company, of New York. Mr. Bissell will at once reorganize the company, which, it is said, will in the future be known as the "Niagara Gorge Railroad."

THE PITTSBURG REDUCTION COMPANY, Niagara Falls, has received two new generators, each of 1000-hp capacity, from the Westinghouse Company and two more are to follow soon. These machines will be placed in the station of the Niagara Falls Hydraulic Power & Manufacturing Company, and will double the output capacity of the lower works of the Pittsburg Reduction Company, which are located on the high bank over the power station. These new generators are to be direct connected to two new turbines which have been ordered by the Niagara Falls Hydraulic Power & Manufacturing Company.

GOVERNOR ROOSEVELT has signed the bill which gives the commissioners of the New York state reservation at Niagara the right to lay surface railway tracks between Fall and Niagara streets on the Riverway for the accommodation of the International Traction Company. This will allow the Traction Company to make a much-desired connection between its tracks at the foot of Falls Street and the tracks on the upper steel arch bridge. The commissioners will control the tracks and lease them to the Traction Company, the right to run over them being revocable. This loop line will be a great relief to the electric road traffic at the Falls.

THE NIAGARA GORGE RAILROAD COMPANY was incorporated at Albany on June 3, with a capital of $1,000,000, to operate the road and franchises of the Niagara Falls & Lewiston Railroad Company, which has gone into voluntary dissolution. The line to be operated extends from Onondaga Street, Lewiston, along the bank of Niagara Falls. The company will also control the franchises of the Niagara Falls Tower Company, the Buttery Whirlpool Rapids Company, the Niagara Rapids View Company, Limited, and the Niagara Whirlpool Rapids Elevator Company, all of which were owned by the dissolved company. The directors are Adjutant General Avery D. Andrews, General Francis V. Greene and George V. Turner, of New York City, and Herbert P. Bissell, Edward W. Eames, Clarence M. Bushnell, William C. Cornwell, J. Henry Metcalf, Bert L. Jones and Herbert H. Hewitt, of Buffalo.

PITTSBURG NOTES.

MR. W. J. BURNS, President and General Manager of the West End Traction Company, is lying very ill in Paris, France.

THE WEST END TRACTION COMPANY contemplates the expenditure of $100,000 in the improvement of its equipment and the extension of its lines.

MR. MORRIS MEAD, the Superintendent of the Municipal Department of Electricity, is very busy just now making some improvements and extensions in the switchboard appliances of his office.

THE CONSOLIDATED STREET RAILWAY COMPANY, of this city, has made a proposition to the local council to elevate its tracks on some of the downtown streets, especially Liberty and Wood Streets.

THE UNITED TRACTION COMPANY has closed a contract for 20 new summer cars with the Laclede Car Company, of St. Louis. These cars will be used on the Woods Run and Manchester branch of the company's system.

ELECTRIC WORKERS' WAGE SCALE.—The local union of electrical workers has presented a scale to electrical contractors which calls for 53 hours' work per week, and all time above that they will expect to be paid "time-and-a-half."

A 45-MILE ELECTRIC RAILWAY.—The Select Council of Johnstown, Pa., has granted a 99-year franchise to the Johnstown & Somerset Traction Company, which is to run an electric railway from Johnstown to Somerset, a distance of 45 miles.

THE ALLEGHENY COUNTY LIGHT COMPANY has contracted with the Westinghouse Electric & Manufacturing Company for ten arc machines that are to be run by ten induction motors—somewhat of an innovation in the operation of electrical machinery.

MR. JOHN E. EARLY, a prominent business man from the city of Mexico, and connected with several important electrical enterprises of the country, has been in this city for some days, and it is said he placed some large orders for electrical power transmission apparatus with the Westinghouse Company.

MR. W. J. HUNKER, JR., who has been superintendent of the Allegheny County Light Company for a number of years, resigned his position a day or two ago to go to the Westinghouse Electric & Manufacturing Company. Mr. Thomas Leisenring, who was chief inspector under Mr. Hunker, has been promoted to the superintendency.

MR. JOHN MURPHY, General Superintendent of the Philadelphia Company, a corporation of this city, which controls and operates the Allegheny County Electric Light Company, and the United Traction Company, has started a warfare against the ubiquitous advertiser who defaces trolley poles and electric poles with numerous posters, signs and pictures.

MR. J. F. MACARTNEY, of London, England, has just placed an order for iron trolley poles with the American Iron & Steel Company, of this city. Mr. Macartney is reported to have given as the reason for purchasing the trolley poles in this city that the English iron and steel manufacturers were loaded with orders for six months ahead. Mr. Macartney is an electrical engineer and contractor and is building electric street railways in several English cities.

OHIO NOTES.

THE CLEVELAND CITY RAILWAY COMPANY has applied for a franchise to operate a new cross town line through Cleveland; also for a franchise for a new suburban line to Rocky River.

TRIALS OF A TELEPHONE COMPANY.—The West Side portion of Cleveland is up in arms against the Cuyahoga Telephone Company, which is preparing to erect poles on several of the principal streets. The people want the wires underground, but the telephone company has a permit to put up poles. A quick-witted woman put a stop to proceedings the other day by jumping into a post hole which had just been dug and remaining there several hours while her husband went to the city and secured an injunction.

MR. R. M. DOUGLAS, who has lately become general manager of the lines of the Cleveland Electric Railway Company, is inaugurating several changes

which he believes will be of benefit to the company. An amusement and club room for the benefit of the car and shop men is being fitted up at Lake View Station, which will be supplied with games of all kinds; also a reading room with files of electrical and scientific journals. Arrangements are being made to give weekly lectures on electrical subjects for the benefit of the employees. Other clubs will be established at the various shops of the company if this one proves a success.

THE CUYAHOGA TELEPHONE COMPANY, of Cleveland, is erecting a ten-story telephone building which will be completed by Oct. 1. The Cuyahoga Company and the United States Telephone Company, which is under the same management, will occupy the three upper floors of the building. The Cuyahoga Company will inaugurate a vigorous competition for Cleveland business. The United States long distance company already has about a thousand miles of toll lines in operation and expects to cover the entire state in the near future. The company also has franchises in Indiana, Kentucky, West Virginia, Pennsylvania and New York. Mr. H. A. Everett is at the head of both companies.

PROJECTED ELECTRIC RAILWAYS.—Hugh Blakely, a prominent business man of Alliance, is at the head of a new company which is planning to construct an electric railway from Alliance to Akron, touching at several neighboring summer resorts. The proposed route has been surveyed and the right of way is being arranged for. It is also stated that the company is looking over the ground with a view to establishing a line from Alliance to Salem, touching the new town of Sebring, which is being laid out by the pottery trust. New York capitalists are said to be interested in these enterprises. Mr. Dudley B. Wick, of Cleveland, has purchased the Alliance (Ohio) Street Railway for $15,334. Mr. Wick is trustee of an organization of Cleveland and Chicago capitalists and it is understood that the purchase of this line is the first step toward building a new road connecting Alliance with Canton. The route has been selected and the right of way is being secured.

A FARMERS' TELEPHONE LINE.—The farmers of Geauga County have a telephone enterprise which deserves attention. Some months ago a company was formed by several prominent farmers to secure cheap telephone service in the county. The cost of the system, including poles, one wire and the necessary work of putting everything into place, was $50 per mile. The stockholders themselves shared in the manual labor attending the construction of the system. One or two expert workmen were required at first, but soon some of the intelligent farmers acquired sufficient knowledge of the details of the work to carry it to completion. A rental of $12 per year is charged for the telephones; this includes furnishing the telephones, making connections and keeping everything in repair. In addition to this the patrons are given free use of two extensive independent lines which extend beyond the borders of the county. A large portion of the farmers in the county have become subscribers and the line is proving a great time saver in the way of securing information regarding prices or needed supplies.

INDIANA NOTES.

A PROVISIONAL GRANT.—At a mass meeting, held by the citizens of Logansport, it was voted that the proper authorities should grant to the Indianapolis & Logansport Traction Company the right of way asked for in the county and city, provided the shops and power house of the road shall be built and maintained in the city of Logansport.

WAGES OF TROLLEY EMPLOYEES INCREASED.—On June 1 the wages of the employees of the Indianapolis Street Railway Company were increased as follows: First three months of service, 15 cents per hour; second three months, 16 cents; after six months, 17 cents. The increase means an addition of $50 per day to the payroll of the company.

DEMURRER SUSTAINED.—The demurrer filed by the Indianapolis Street Railway Company to the complaint in the suit of Charles F. Smith against the railway company for $5000 damages is sustained. The suit was brought by Smith with a view of testing the law under which the recent street railway franchise was granted. It was filed after Smith had been ejected from a car, after offering a 3 cent fare, which was refused. Smith has taken an appeal to the Supreme Court.

OWNERSHIP OF PUBLIC UTILITIES.—Statistics relating to the municipal and private ownership of electric light, gas and water plants of Indiana show that there are twenty-eight electric light plants in the state, six of which are operated under private ownership, the rest under municipal ownership. It was impossible to get complete statistics of all the plants, inasmuch as many of the corporations refused to answer the inquiries because they did not care to have their affairs open to the public. The report and tables will be invaluable to cities investigating the advisability of buying or constructing waterworks, gas or electric plants of their own, or for the sale of bonds.

THE REORGANIZED STREET RAILWAY INTERESTS IN INDIANAPOLIS.—The Guarantee Trust & Safe Deposit Company of Philadelphia has delivered, under the agreement, the stocks and bonds of the Indianapolis Street Railway Company to the holders of the Citizens' Company stock. The basis of the exchange is 50 per cent., in the Indianapolis Company's 4 per cent. bonds and 10 per cent. in new stock. There has also been listed on the Philadelphia Stock Exchange $5,000,000 of common stock of the Indianapolis Street Railway Company, par $100, full paid, and $3,750,000 general gold 4 per cent. bonds of the Indianapolis Company. These are a part of the stock and bonds provided for in the reorganization of the local street railway affairs at Indianapolis recently.

THE MAROTT COMPANY'S TROUBLE.—The affairs of the Indianapolis & Logansport Electric Railway Company are not in as satisfactory shape as the officials desire. The commissioners of Carroll county granted a franchise last fall to a company composed of Logansport citizens, who recently turned their rights over to the Marott Company. The commissioners repudiate this transfer and aver that it renders the franchise void. Many of the citizens of Carroll County are opposed to the road and the commissioners are deferring action on account thereof. Each of the numerous small towns in the county want the line and an effort is being made to bind the company to build spurs from the main line to said towns in consideration of a franchise through the county. The feeling is high and the commissioners are fearful of results in either event.

THE MARION RAILWAY ABSORPTION.—The report that the Union Traction Company had purchased the Marion (Ind.) street railway system and the Summitville extension has proven untrue. The officials of the Marion system regard the recent request of the Union Traction Company for a franchise over the streets of that city as a bluff, to aid in getting cheap option on the Marion and Summitville lines and the Marion Street Railway, and then sell the whole system, including the proposed Indianapolis extension, to an Eastern syndicate at a big profit. Manager Hury says that negotiations are well under way, but just when the deal will be consummated he would not state. The plan is for Henry and McCullough, the gas-belt electric plant kings, to make the purchase and merge the Marion system with that of the Union Traction, of which McCullough would be a heavy stockholder. This would give the Union Company over 75 miles of track in operation, with 50 miles projected for construction this season and practically a monopoly of the electric lines in and between the gas-belt towns and cities.

CHICAGO NOTES.

MR. RUDOLPHUS FULLER, of the Fuller Company, Detroit, Mich., was in Chicago last week.

MR. W. D. McQUESTEN, of the Sprague Electric Company, New York, has been in Chicago on a business trip, looking after the interests of his company.

THE DAKE ENGINE COMPANY, of Grand Haven, Mich., is building a special compound hoisting engine with boiler, and a Dake engine direct-connected to centrifugal pumps for shipment to Panama for mining purposes.

THE ELECTRICAL INSTALLATION COMPANY, Chicago, has just closed a contract for the complete rehabilitation of the Vicksburg, Miss., electric lighting system. Work will be started immediately and rushed to completion within ninety days.

MR. H. L. BRINTNALL, of Saginaw, Mich., reports the first contract for lighting electrically an entire city, it is said. It was awarded to the Swift Electric Light Company of that city, of which he is secretary, treasurer and general manager. He has, in fact, run the company for 16 years.

MR. H. E. TEMPLE, manager of the Electrical Repair Works, Chicago, reports that in addition to its general line of business it has lately equipped a new shop for the manufacture of the following line of specialties; Switchboard material, sockets, switches, cut-outs, and a new style of link-fuse, on which soldering is unnecessary.

MR. MARTIN DETAMBLE has placed a contract with the Western Electric Company, Chicago, for one 40-kw Western Electric direct-current generator and a switchboard for the same. The Construction Department of the Western Electric Company will install the apparatus and do the wiring for five hundred 16-cp lamps. The installation is for the building, 153 West Jackson Boulevard.

MR. J. G. POMEROY has just been appointed Western manager for the Adams-Bagnall Electric Company, to be located at 317 Dearborn Street, Chicago. He has disposed of his interests in the firm of McGill & Pomeroy, large manufacturers' agents, and, although the concern will still enjoy the use of his well known name, his energies will be concentrated on Adams-Bagnall work. Mr. Pomeroy was with the Brush Company for seven years, and has had a previous connection with the important interests he now represents. He is a strong believer in the superior merits of the Adams-Bagnall lamps, and they will now be pushed most vigorously and successfully.

MR. CHARLES E. GREGORY, Chicago, has refitted the former works of the Standard Electric Company, consolidating the machine shop on two floors, using the main floor for a wareroom for dynamos, motors and heavy sundries and the upper floors for light merchandise. The entire six floors present a scene of activity. Mr. Gregory reports business exceedingly good and a large demand for the material he handles. An important feature of his work is the manufacture of series arc lamps for all purposes. One especially fine lamp of his manufacture is the Pfluger park lamp, 400 of which are in use in the local parks. Mr. Gregory promises the trade a 125-hour enclosed series arc lamp within the next few months.

WISCONSIN NOTES.

MESSRS. PETERMANN AND WALLBER, of Milwaukee, have dissolved partnership. This firm has been doing electrical contracting business for the past two years.

OVERHEAD LINES DAMAGED BY STORM.—Much damage was done to the aerial construction of the various telephone and telegraph companies' systems in this section by the recent severe wind and rainstorms. The storms were accompanied by severe lightning, many fires and much damage being done by the discharges.

SALE OF RAILWAY PROPERTY IN FOX RIVER.—The negotiations for the sale of the Edison Electric Company's railway to the Fox River Railway and the Oshkosh Traction Company are stated by officers of the Fox River company to be practically concluded in favor of the Appleton company. The Fox River Company is making its plans for the practical rebuilding of the local system after it purchases the property, as is now expected will be done.

THE SHEBOYGAN STREET RAILWAY COMPANY has obtained a sufficient number of signers to its petition in Sheboygan Falls for the extension of its line from Sheboygan to that village. The company asks aid to the extent of $5000 from the village, and a majority of the taxpayers have signed the peti-

tion and favor the issue of bonds to that amount, the village of Sheboygan Falls to take the amount in company stock. It is expected that cars will be running by Aug. 1.

ST. LOUIS NOTES.

TELEPHONE EXCHANGE SOLD.—Word comes from Butler, Mo., that the Butler and Rich Hill Telephone Exchange has been sold by H. Reinheimer to a company represented by W. M. Rae, of Shelbina, Mo. The consideration was $10,000 in cash. The new company took possession June 1.

TALK OF STREET RAILWAY CONSOLIDATION.—A consolidation of the two electric lines now running between East St. Louis, Ill., and Belleville, Ill., is one of the probabilities of the near future. Negotiations have been in progress for some time and the only stumbling block appears to be a question of values. The two roads are the St. Louis, Belleville & Suburban Railway Company and the St. Louis & Belleville Electric Railway Company. The latter is owned by St. Louis capitalists and the first by Chicago people. The latter road, it is understood, has offered to buy the former and daily conferences have been held. Each road claims to have an advantage over the other and the rivalry is keen. The roads are practically parallel lines between the city limits of East St. Louis and the city limits of Belleville.

TEXAS AND MEXICO NOTES.

ELECTRIC LIGHT PLANT FOR MATAMORES.—A company has been organized to establish an electric light plant in Matamores, Mexico. The same company proposes to construct an electric street railway from Matamores to the port of Santa Cruz, at the mouth of the Rio Grande.

SALE OF A MEXICAN STREET RAILWAY.—Mr. Francisco Armendiaz, a millionaire of Monterey, Mexico, has sold the street railway in Matamores, Mexico, of which he was owner, to Mr. William Anderson, representing a syndicate of New York capitalists, who are also negotiating for a concession from the Mexican government to build a railroad from Matamores to Monterey.

NEW ELECTRIC LIGHT COMPANY IN EL PASO.—A company is being organized at El Paso, Texas, to establish a new electric light plant in that city. Nearly all of the stock has been subscribed. The principal stockholders are A. Krakauer, J. P. Dieter, A. Courchesne and Felix Martinez. Mr. T. H. Davidson, a capitalist of Alamagorda, Texas, has also taken steps looking to the establishment of an electric light plant in El Paso.

PACIFIC COAST NOTES.

MR. E. M. FRASER, of the Fraser Electric Elevator Company, San Francisco, is visiting the principal cities of the Eastern States, on a business trip in the interests of his elevator system, which has been highly successful on the Coast.

A NEW OREGON ELECTRIC RAILWAY.—The Oregon City, Molalla & Southeastern Electric Railway Company's surveyors are running preliminary lines from Oregon City, Oregon, towards Molalla. Mr. N. O. McLoughlin is general manager, and J. Henry Smith chief engineer of the company.

ELECTRIC MINING POWER PLANT.—The directors of the Merced Mining Company, of California, recently voted $750,000 for the purpose of installing an electric power plant. The company owns a large amount of mining property in the Coulterville mining district. The power developed will be used in operating the mining works of this and other companies.

MUNICIPAL MIS-CONTROL.—The new Board of City Trustees of Alameda, Cal., has carried economy to extremes. By the cutting down of the force of men operating the municipal electric lighting system, the remaining employees in the station were forced to stand 14-hour watches. The day engineer recently fainted at his post as a result of overwork.

THE INDEPENDENT ELECTRIC LIGHT & POWER COMPANY, of San Francisco, will share the use of poles outside the fire limits, with the Mutual Electric Light Company. Among the contracts recently awarded by the company were one for Babcock & Wilcox boilers aggregating in capacity 8000-hp; one for three McIntosh & Seymour compound condensing engines, of 2400-hp each; one for the direct connected two-phase alternators to the Westinghouse Electric & Manufacturing Company, and the cables for the distributing system to the Standard Underground Cable Company. The lighting system is to be in operation within a year.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., has recently issued a very complete catalogue (No. 12), which illustrates and describes over 300 sizes and kinds of presses suitable for all kinds of sheet-metal work. It has recently received a large number of foreign orders from England, France, Germany and South Africa for its larger presses suitable for electrical work. It recently designed a very neat machine which it calls its disk notcher, and is suitable, as the name suggests, for notching disks for armature work. Manufacturers of electrical goods will do well to write the company, as it is always glad to give estimates upon receipt of drawings or samples. A copy of catalogue No. 12 will be sent on application.

CANADIAN NOTES.

STREET CAR FENDERS IN MONTREAL.—The campaign for better street car fenders, now being waged against the Montreal Electric Street Railway, has received the approval of the Police Committee of that city. The committee has passed a resolution calculated to hasten the choice of a serviceable fender by the company.

THE ELECTRICAL SHOW AT NEW YORK.—Mr. Thomas Ahearn, managing director of the Ottawa Electric Street Railway, attended the Electrical Exhibition at New York, and states that the exhibition of horseless carriages was a most wonderful one. In all probability the Ottawa Car Works will soon enter upon the manufacture of automobiles. An arrangement has already been made with the Electrical Vehicular Car Company, of Chicago, for a number of its horseless carriages to be exhibited in Ottawa within a few weeks.

ELECTRIC ILLUMINATION OF CLOCK DIALS.—Dr. R. R. Gareau, of Detroit, Mich., is in Ottawa at present, in connection with the new system of electric lighting which is being installed in the tower clock in the central block of the Dominion parliamentary buildings. By Dr. Gareau's system the clock will be lighted from the exterior of the dial. In the new system an incandescent lamp of 50-cp is affixed to the centre of the face of the clock. Shades are so arranged that the entire light is thrown directly on the clock dial, and the figures can be readily discerned at a great distance. By the old system now in use, it required lights of 200-cp operated inside the tower to effect the illumination.

IMPROVING OTTAWA'S TELEPHONE SYSTEM.—The Bell Telephone Company has completed arrangements for installing a new plant in Ottawa, which will give the capital of the Dominion a service as complete and up to date as any city in the world. The whole city has been rewired and the subscribers will get a new instrument designed on a different principle from those in use at present. The more elaborate and costly part of the equipment will be the new switchboard to be put in the central office. The board will be equipped with colored electric lights, which will change when "central" is wanted. The removal of the telephone from the hook automatically lights the particular lamp belonging to the subscriber's line; the operator makes the connection with the station asked for and, when the person called removes his telephone from the hook, the lamp upon his line is also lighted. Bells will only be used to ring up a station. When both lamps go out the operator knows that the conversation has ended. The whole system will be in operation in a few days and is being installed under the supervision of the best electrical experts on the continent. It will entail an expenditure of $150,000.

General News.

THE TELEGRAPH AND TELEPHONE.

INDIANAPOLIS, IND.—The Northwestern Indiana Telephone Company, of Lake, Porter and La Porte Counties, has been incorporated with a capital stock of $8000.

COLLINWOOD, OHIO.—The Collinwood Home Telephone Company has been organized here with a capital stock of $25,000. The incorporators are W. G. Patton, J. B. Wood, J. B. Durkin, J. M. Hard and E. L. Barber.

PRESCOTT, ARIZ.—The Prescott Electric Company is rebuilding its telephone line between Prescott and Walker, and when that task is completed it will build a new line from Walker to Crowned King. The starting up of many new mines renders the extension of the telephone system a necessity.

VAN WERT, OHIO.—The Home Telephone Company has secured a unanimous vote in the council on the resolution directing the Mayor and the City Solicitor to prevent the Bell or any other telephone company from entering the city. The Bell company has been making an effort to gain a foothold in this place.

RURAL RETREAT, VA.—This place is to have a telephone system. The Rural Retreat Telephone Company is the name of the new concern just organized to do a telephone business. The capital stock is $5000, and the names of those at the head of the enterprise are J. M. Phipps, C. W. Davis, J. W. Eiffert, C. C. Catron, all of Rural Retreat.

HARRISBURG, PA.—The American Telephone Company, capitalized at $1000, has been chartered here to build a telephone line in the counties of Allegheny, Beaver, Lawrence, Butler, Armstrong, Westmoreland and Washington. The company's office will be in Pittsburg. The directors are Xavier Wittmer, Henry Wittmer, Pittsburg; D. C. Cawley, Allegheny; Frederick Klussman, Bennett; F. B. McMillan, Glenshaw.

NEW HAVEN, CONN.—The Judiciary Committee of the State Legislature has reported a very important general telephone bill which is likely to pass. It drops the requirement in the former bill that all telephone enterprises not organized under a special Connecticut charter shall be excluded from doing business, and now allows them to be organized under the joint stock laws, but they must pay in cash 50 per cent. of stock capital before they begin work; can issue only 50 per cent. of bonds on cost of plant as sworn to the State Comptroller by the president or treasurer of the company and by a civil engineer, and compels the approval of the Superior Court on the question of public necessity and convenience after due notice to other parties at interest. The new bill, if passed, will be in effect a general telephone law based, as regards the appeal to a Superior Court, on the Connecticut general street railway law, and, as regards the good faith of the enterprise, on the general steam railway law of the State.

ELECTRIC LIGHT AND POWER.

WILKESBARRE, PA.—The Economic Electric Company has been organized in this city. It has a capital stock of $75,000.

JACKSON, MINN.—A special election was held here recently to vote on the proposition to bond the village in the sum of $10,000 for the purpose of estab-

lishing an electric light plant. The proposition was carried by a large majority.

KAUKAUNA, WIS.—The Kaukauna Electric Light Company has been sold out and has been reorganized. The officers of the new company are: President, manager and treasurer, Thomas R. Earles; vice-president, M. H. Hussey and secretary, W. H. Nelson.

ATHENS, TENN.—The East Tennessee Light & Power Company has been organized to do an electric light and power business. The capital stock is $10,000, and the incorporators, W. R. Hall, J. E. Hall, B. M. Brewer, H. S. Bosler and W. B. Swaney.

TIVERTON, R. I.—The Tiverton Electric Light Company has been organized to deal in electricity, electrical instruments, etc. The capital stock is $100,000. The incorporators are J. R. Hicks, Fall River; G. R. Lawton, R. J. Barker, J. H. Wilcox, and R. J. Barker, Jr., all of Tiverton.

NILES, OHIO.—The Niles Electric Company, with a capital stock of $20,000, has been organized here to furnish electric light, heat and power. The names of the incorporators are E. A. Wilson, F. E. Wilson, Mrs. Nancy Wilson, Etta Wilson and Emma W. Wilson, all of Niles, Ohio.

HACKENSACK, N. J.—The Hackensack Gas & Electric Company has absorbed the lighting companies of Englewood, Rutherford and Ridgewood. The consolidated company is to be known as the Gas & Electric Company of Bergen County. It has a capital stock of $2,000,000, and Mr. Frank D. Poor will be its president.

HARTFORD, CONN.—The incorporators of the Essex Light & Power Company have voted to accept the charter. Messrs. T. C. Perkins & Co., engineers, of this city, will draw plans and have charge of the construction of the plant, which will at first have a capacity of 2000 incandescent lights. The new company has elected officers as follows: President, Frank R. Gallagher, of Essex; vice-president, Thomas C. Perkins, of Hartford; treasurer, L. L. Wooster, of Essex; secretary, Charles R. Marvin, of Deep River.

HOBOKEN, N. J.—President A. K. Bonta, of the North River Light, Heat & Power Company, has offered to furnish electric light to the city for one year free of charge. In addition to free lights for a year, the company offers to supply illumination thereafter at not more than $80 per light per year. Under the present contract with the North Hudson Light, Heat & Power Company, the city pays $138 per light per year. The Tax Commissioners to whom the offer was made have passed a resolution accepting the same and requesting the Common Council to give it favorable consideration.

SOUTH BEND, IND.—The Edison Electric Company of South Bend has been incorporated at South Bend, Ind., with $100,000 capital. The incorporators are Otto M. Knoblock, George A. Baker, A. W. Morrell, George Wyman and Samuel S. Perley. The council will be asked for a franchise and the company will immediately proceed to put in a modern generating plant, using the three-wire system and 110-volt direct low tension current for commercial lighting. The feeders and wires in the central part of the city will be run in conduits, and in every particular the plant will be a first-class one. Messrs. Knoblock and Morrell of the incorporators are connected with The Miller-Knoblock Company, South Bend, Ind., manufacturers of electrical machinery.

THE ELECTRIC RAILWAY.

JAMESTOWN. N. Y.—The Jamestown Street Railway is to be extended to Falconer.

ROMULUS, PA.—The Township Board of this place has granted a franchise to Washington I. Robinson, of Detroit, to build an electric railway from Detroit to Romulus, Belleville, and Toledo.

HARRISBURG, PA.—The Westchester, Kennett & Wilmington Electric Railway Company has been chartered to build a railway eight miles in length. The company is capitalized at $50,000. Mr. George W. Taft of Kennett Square, is president.

SCRANTON, PA.—The Scranton & Pittston Railway Company has been granted a franchise by the Borough of Old Forge to lay its tracks on the main street of that town. This improvement will give another route between Scranton and Pittston.

SHREWSBURY, N. J.—The carhouse in this place of the Red Bank & Long Branch Electric Railway was destroyed by fire recently. Sixteen cars were burned. The loss on the building and the cars amounts to about $50,000; it is covered by insurance.

YPSILANTI, MICH.—The Ypsilanti & Saline Railway Company has been incorporated in this state to construct and operate street railways. The capital stock is $2500 and the incorporators are R. W. Hemphill, H. P. Glover, J. D. Hawks, all of Ypsilanti.

SAN JOSE, CAL.—The First Street Electric Railway was sold at public auction a few days ago under foreclosure proceedings. It was purchased by Mr. George Tourney, of San Francisco, for $225,000. The system embraces 19 miles of track and is in fair condition and full operation.

PITTSBURG, PA.—The Consolidated Traction Company has awarded contracts for the construction of the Suburban Rapid Transit and South 22d Street Railways. The two lines will cost between $600,000 and $700,000. Ninety-pound girder rails will be used. The poles will be made by the Pittsburg Steel Works and the cars by the Laclede Car Company, of St. Louis.

PROVIDENCE, R. I.—The Rhode Island Suburban Railway Company has petitioned for incorporation with a capital stock of $2,500,000. The company has obtained from the United Traction & Electric Company the rights acquired by the latter in the Warwick & Oakland Beach branch of the New York, New Haven & Hartford Railway and will obtain similar rights on the Bristol branch.

BUENOS AYRES, ARGENTINE.—The Buenos Ayres Electric Tramway, Limited, has been registered in London, England, with a capital stock of $1,500,000. An agreement has been made with Mr. Carlos Bright, of Buenos Ayres, and the company is to carry on a business in tramways and other electrical enterprises. The new undertaking will probably bring considerable business to American manufacturers, even though the company and capital are British.

BETHLEHEM, PA.—The Bethlehem Construction Company will be prepared to receive bids for the grading and laying the track, erecting poles and string wires for the electric road running between Bethlehem and Nazareth. The plans and specifications can be seen at the office of the company, Globe Building, Bethlehem, Pa. Bids will be received up to 3:00 o'clock, Monday, June 12, 1899. J. H. Wolle is secretary.

NEW YORK, N. Y.—The Rockaway Electric Railway Company and the Cross-County Railway, each with a capital stock of $250,000, have been incorporated in the Queens County Clerk's office, in Jamaica. It is stated that Mr. Patrick H. Flynn, of Brooklyn Borough, is behind the two companies. The Rockaway Electric Railway Company proposes to build a double track surface railway at Rockaway Beach about four miles in length, and the Cross-County Road will construct a trolley line from Willet's Point to College Point, through Jamaica.

WATKINS, N. Y.—The Penn Yan, Lake Keuka & Southern Railway Company has been organized with a capital stock of $400,000. The distance between Lake Keuka and Penn Yan is about 35 miles. The road will be operated by electric power and freight cars will be run. The names of the incorporators are A. P. Zimmerman, Frank Plaisted, Bradford, N. Y.; Francis Barnes, Francis C. Barnes, Jr., Jersey City; H. D. Mason, New York City; Clermont C. Covert, Charles A. Cockrof, of Binghamton; Charles B. Brown, of Hartford, and Coleman Garnes, of Hoboken.

SISTERVILLE, W. VA.—An electric railway will be built between this city and Middlebourne, the county seat, 12 miles distant. Messrs. John Howard of Wheeling and J. Lee Harne of Middlebourne, together with several Pittsburg and New York gentlemen, are at the head of the enterprise. The road will cost about $300,000. There is some talk of extending the line so as to take in several small towns on the Ohio side of the river. A trolley line from Clarksburg, W. Va., to Bridgeport, W. Va., a distance of about 18 miles, will also probably be built in the near future.

HOUSTON, TEXAS.—The Houston, Oak Lawn & Magnolia Park Railway Company has been organized and is now operating the six-mile road hitherto known as the Houston Belt & Magnolia Park Railway. General Manager Fuller was authorized to secure bids for the necessary electrical equipment for that portion of the road between the city and Oak Lawn, a distance of some two miles. The old road has not been operated for four or five years. The names of the incorporators are president, Jonathan B. Frost, of Atlanta; vice-president and general manager, Herbert E. Fuller; secretary and treasurer, L. E. Mills; directors, J. B. Frost, H. E. Fuller, L. E. Mills, N. L. Mills, E. L. Dennis and J. G. Locke.

LEGAL.

AN ELECTRIC PASSENGER RAILROAD on a country highway is held in Zehren vs. Milwaukee Electric Railway Company, Wis. S. C. (41 Lawyers' Reports Annotated, 575), to constitute an additional burden which requires the consent of the abutting owner and payment of compensation.

STATE STREET TRUST COMPANY INTERVENES.—The State Street Trust Company, of Boston, has filed an intervening petition in the Superior Court at Indianapolis in the case of State Bank of Indiana vs. Indianapolis & Broad Ripple Rapid Transit Company. The petition sets out that in April, 1895, the Broad Ripple Company executed 400 one-thousand-dollar bonds secured by a mortgage or deed of trust to the petitioner and to Ranald T. McDonald. These mortgages provide that in case of the company's default of payment of any of the principal or interest, the trustees might declare the bonds and interest to be due and payable at once. The mortgages cover the lines, plant, real estate and franchises of the company. The semi-annual installments of the principal and interest, amounting to $12,030 each, between Oct. 15, 1895, and April 15, 1897, have not been paid, it is averred; neither have the taxes, amounting in all to $3535.75, been paid. One of the trustees has died, and the petitioner, who is the other trustee, now declares the bonds due and payable and asks the court for judgment in the sum of $500,000 and the foreclosure of the mortgage.

PERSONAL.

MR. CHARLES F. BRUSH, of Cleveland, Ohio, has received from the American Academy of Arts and Sciences in Boston the award of the Rumford medals for the development of arc lighting.

MR. LUTHER STIERINGER, released from professional cares at the New York Electrical Exhibition, has gone West for a vacation and will next be heard of as cooling himself on an Alaskan glacier. He expects to be away for a couple of months.

COL. J. H. SHAY, so long and well known in the belting field, was in New York City recently attending the convention and the exhibition. He is now the representative of the Chicago Belting Company, and continues to keep a sharp eye on electrical development.

MR. W. H. PREECE, who was already a Commander of the Bath, has now been made a K. C. B. upon the occasion of the Queen's birthday. Sir William has won his honors by fifty years of hard work and brilliant achievement in telegraphy and all the later electrical arts.

MR. RUDOLF RIEGGER, one of the electrical engineers of the Oerlikon Works, who has been installing apparatus in Mexican California, has made his way home via this country, taking in the electrical exhibition and the National Electric Light Association Convention, as well as visiting several power houses.

MR. GEORGE STANMORE, late general manager of the American Electrical and Maintenance Company, and A. K. Warren & Co., of New York City,

has been appointed special sales agent for Greater New York for the Columbia Electrical Supply Company, 94 Liberty Street and 329 Fourth Avenue, New York. Mr. Stanmore's long experience in the trade and his personal popularity assure him success in his new undertaking.

MR. W. W. GRANT, who has for the last seven years been connected with the Westinghouse Electric & Manufacturing Company, has been transferred to Canada, where he will represent the company in conjunction with Ahearn & Soper, who are well known electrical contractors, with their headquarters in Ottawa. Mr. Grant has had a wide experience, both in the engineering and commercial sides of the electrical business, and is well equipped to make a very creditable showing in his new field. For the last two years he was connected with the New York office and in that time has not only done some valuable work for the company, but has made many lasting friends in his district. Mr. Grant is a son of Sir Charles Grant, a prominent Canadian.

GREENE—CAMPBELL.—A wedding that attracted a number of people from New York occurred at Schenectady, N. Y., on the afternoon of May 31, when Miss Harriet Mumford Campbell was united in marriage to George De Bockton Greene, of the General Electric Company. Miss Campbell is a daughter of the late Douglass Campbell, and Mr. Greene is a brother of Mr. S. Dana Greene. The bridesmaids were Miss Beattie, Schenectady; Miss Cox, Cherry Valley; Miss Farnam, New Haven, Conn.; Miss Bennett, Hartford, Conn., and Miss Alice Maude Baldwin and Miss Marion Gregory, New York. Mr. Greene was attended by his brother, S. Dana Greene, as best man, and the ushers were Robert S. Hale, Boston; Carleton Greene, Phillips Burgess, Henry P. Maury, William A. Campbell and Douglass Campbell, of New York.

KORTHEUER—CHEESMAN.—Hermann Francis Kortheuer and Miss Teresa Cheesman, daughter of Dr. and Mrs. Hobart Cheesman, of 171 West Ninety-fifth Street, New York City, were married on the evening of May 31 in the Church of Zion and St. Timothy, in West Fifty-seventh Street. The Rev. Dr. Henry Lubeck performed the ceremony, which was followed by a reception at the home of the bride's parents. Miss Florence Palmer Cheesman was her sister's maid of honor. The flower girl was Miss Dorothy Howland Cheesman. The bridegroom was attended by his cousin, John Ewen, of Spuyten Duyvil, as best man. The ushers were William Sergeant, of Spuyten Duyvil, a cousin of the bridegroom; Henry F. Peake, Frederick P. Delgado, Fritz Strothman, and Hubert Cheesman, a cousin of the bride. Mr. Kortheuer has been actively engaged in electrical engineering for some years and is now connected with the telephone switchboard department of the Western Electric Company in New York City.

Trade and Industrial Notes.

THE S. K. C. lightning arrester for alternating current apparatus is fully illustrated and described in Bulletin 104 issued by the Western Electric Company, Chicago.

THE WESTERN ENGINEERING COMPANY, Denver, Col., has changed its name to Skinner & Sethman. This firm represents several important companies.

THE VACUUM OIL COMPANY, of Rochester, is rapidly replacing steam with electric power in nearly all the departments of its plant on Plymouth Avenue.

THE ROTH GAS ENGINE COMPANY, Indianapolis, Ind., has been incorporated, with a capital stock of $50,000. The incorporators are C. C. Roth, G. W. Roth and C. E. Barrett.

THE WESTERN ELECTRIC COMPANY, Chicago, has mailed to the trade, bulletins on the S. K. C. single phase motors and Type G transformers. Any one who has not received copies of Bulletins 101, 102 or 103 should write for same.

FANS.—Notwithstanding the fact the spring season had not been warm enough until this week to be an ideal season for the fan motor business, the Electric Appliance Company of 92 and 94 West Van Buren Street, Chicago, reports that its sales of fan motors up to date are very encouraging and indicate that the demand during the season will be very heavy.

THE JOHN A. ROEBLING'S SONS COMPANY of New York was incorporated at Albany a few days ago with a capital stock of $100,000. The directors at Washington A. Roebling, Chas. B. Roebling, Jr., Frank O. Briggs, Charles G. Roebling and Ferdinand W. Roebling, of Trenton, N. J., and Henry L. Shippy and Edmund Roebling, of New York City.

THE SPEER CARBON COMPANY has been incorporated at Dover, Del., to manufacture electrical machinery and supplies. The names of the incorporators are Andrew Kaul, J. S. Speer, St. Mary's, Pa.; Louis Strenoer, Erie, Pa., and Burr E. Cartwright, Ridgway, Pa.

MESSRS. J. H. BUNNELL & CO., 76 Cortlandt Street, New York City, issued a dainty little leather folding pocketbook as a souvenir of the Railway Telegraph Superintendents' meeting, and are now experiencing a brisk demand for any "left-overs." Applicants who get in before the supply fails will have reason to count themselves lucky.

HISTORICAL RHEOSTATS.—The Cutler-Hammer Manufacturing Company, 70 West Jackson Street, Chicago, informs us that it is making a collection of rheostats, and already has a number of curious specimens. To make this collection more complete, it offers to replace ten starting rheostats, over five years old, and under 10-hp, with its latest type of this apparatus.

THE ILLINOIS ELECTRIC COMPANY, Chicago, agents for Lundell fans, has received its first shipment, consisting of 1000 assorted motors. This company states that it will have one of the most attractive telephone catalogues ever published about July 1, and requests the trade to write for copies.

THE UNITED STATES ELECTRIC & SIGNAL COMPANY has been organized in Portland, Me., to manufacture electrical signals, etc. The capital stock is $50,000, and the incorporators are F. E. Withee, J. R. Devine, Newton Highlands; C. E. Rand, Newton Centre; W. H. Rand, J. H. Nickerson, and A. L. Barbour, West Newton, Mass. The object of the company is to manufacture electric signals for single line electric railways.

THE ROME BRASS & COPPER COMPANY, Rome, N. Y., has placed an order for the steel buildings for a large brass plant with the Berlin Iron Bridge Company of East Berlin, Conn. The contract comprises a boiler house and an engine house 40 feet wide and 120 feet long; a casting shop 50 feet wide and 90 feet long, and a tube mill 120 feet wide and 200 feet long. The framework of all these buildings is steel.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, Mo., is still keeping pace with the times with its usual spirit of push and energy. Its numerous salesmen are at the present time constantly seen hustling for business in nearly every locality in the central, western and southern states, and, judging from their genial attitude and general appearance of satisfaction, they are evidently receiving their full portion of patronage.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., has added to its trade literature catalogues describing its direct-connected railway generators, lightning arresters for alternating current and direct-current circuits, central station transformers and transformer fuse blocks, alternating current fan motors for 50 and 100-volt circuits, direct current fan motors for 100-125-volt circuits, and Tesla polyphase induction motors, type C.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY.—During the past week the Western Telephone Construction Company has been busy placing a lot of new machinery in its factory at 250 South Clinton Street, Chicago. It is practically a duplicate of that in present use, and gives the company double the former capacity of its machine shops. The company reports an extraordinary order business, and the receipt of most flattering letters with reference to the recent improvements in its telephone apparatus.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, 831 Arch Street, Philadelphia, Pa., has issued a very complete catalogue and price list of tools and appliances for electric light, railway, telegraph and telephone construction; also small tools for electricians. The catalogue is illustrated with cuts of pliers and wire cutters of all kinds, clamps, grips, gloves, climbers, wrenches, tool bolts, bits and augurs, screw drivers, magneto testing bells, wire gauges, torches, etc., etc. A copy should be in the hands of every construction superintendent and foreman.

THE AMERICAN ELECTRICAL & MAINTENANCE COMPANY, 451-453 Greenwich Street, whose organization was recently noted in these columns, has purchased from the receivers of the American Electrical & Maintenance Company the entire business of the latter, including all maintenance and repair contracts and the machinery, tools, supplies, etc. Mr. A. K. Warren is the manager of the new concern and will give his personal superintendence to all work done by it. Mr. F. James Reilly, treasurer, will have full charge of the company's financial affairs. The new company states that it has ample cash capital to enable it to carry out promptly any contracts that it may hereafter be favored with.

THE MAXWELL M. MAYER ELECTRIC COMPANY, 2369 Second Avenue, New York, has issued a bulletin describing its direct-current motors and dynamos. The standard motors are wound for 115 and 230 volts and the dynamos for 115 volts. The frames constituting the magnetic circuit of these machines are cast in one piece of open-hearth steel, and bolted to a substantial cast base which also has a support or pillow block cast with it. The field coils are separately wound on well insulated metal spools which are slipped over and secured on the magnet cores. The armatures are of the slotted drum type and are finely laminated, and the conductors have a large carrying capacity, enabling them to stand considerable overload without injury. The commutators have large contact and wearing surfaces, and are of tempered copper insulated with sheet mica throughout. Carbon brushes and self-feeding brush holders are used.

THE CROCKER-WHEELER COMPANY has just issued its Bulletin No. 8, which describes some specially interesting types of machines. It treats of motors with characteristics for special work. The machines described are grouped into three classes, first, mill or enclosed motors; second, elevator motors; third, brake motors. Under the head of mill motors is also described the company's car motor, and under the head of elevator motors, its shop motor. Reference is also made to the company's controllers of the sizes used with the mill motors. The investigation which the Crocker-Wheeler Company's engineers have made of the heating time average is a careful analysis of the heating of a machine in intermittent use for four hours. Curves of continuous and intermittent heating and the resulting rate of temperature rise are also given. The manuscript for this bulletin was written by Dr. S. S. Wheeler, president of the company.

AUTOMOBILITES IN MILWAUKEE.—Milwaukee is to have an automobile service. The Whitney-Widener-Elkins Electric Vehicle Syndicate will introduce an automobile cab, delivery and express wagon service. Steps are now being taken for the formation of a company of local capitalists, which will have the direct management of the concern's business in the city, though the parent company of New York will probably retain a controlling interest in the stock. The plan is to supply a cheap cab service, as well as a delivery system for merchants and truck system for the needs of manufacturers and jobbers, also for a general express and transfer business. The Milwaukee Electric Vehicle Company will be one of a dozen or more to be organized in cities chosen by the syndicate for the immediate introduction of its various styles of equipages. Its effect will be prodigious on all lines of business.

THE PITTSBURG TRANSFORMER COMPANY, Pittsburg, Pa., has just issued a new catalogue of its Type "K" transformer. This transformer is of the "core" type, the iron having the form of a rectangular letter "O," on the long side of which are placed the windings. It is mounted in a cast iron case and may be operated dry or immersed in oil. The catalogue gives information regarding the efficiency, iron loss, copper loss, and regulation of the transformer, and data of special interest to those utilizing alternating currents. It

contains an extremely instructive and interesting discussion of this type of transformer. The output of the company's shops has steadily increased during the past year.

THE STANLEY INSTRUMENT COMPANY, Great Barrington, Mass., has just issued a catalogue of its wattmeters for alternating current circuits. These instruments were exhibited at the Electrical Show at Madison Square Garden, and attracted much attention. They operate to integrate in proportion to the electrical energy in circuit. The use of the magnetic suspension or flotation system sustains the moving part of the meter in a frictionless manner. The company guarantees the good performance of its meters for a period of three years. The construction of the instrument is described, and illustrations of its principal features greatly assist in obtaining an intelligent understanding of its operation. These meters are made in 8 standard types, and register in kilowatt hours without a constant.

THE BULLOCK ELECTRIC MFG. CO., of Cincinnati, O., is experiencing the practical results of prosperous times, coupled with a record for high grade electrical machinery. Its new factory, with treble the capacity of its former works, and with new tools being added almost daily, finds it very difficult to supply promptly the machines called for by its sales department. This difficulty, however, will soon be obviated by increased facilities. Numerous special machine tools, which have been delayed by the crowded condition of the maker's factories, are soon to arrive, and with these in operation, it will be possible to deliver more promptly. The type "N" Bullock slow speed motor, so admirably adapted to the driving of machine tools and other machinery by direct connection, is receiving much deserved attention from consulting and contracting engineers both at home and abroad.

THERMOSTATIC FIRE DETECTIVE CABLE.—Messrs. Stanley & Patterson, of New York, have recently placed an equipment of the Montauk automatic thermostatic fire detective cable in the home of Mr. Joseph Pulitzer, of the New York *World*, and the firm of Doscher & Hartwell, electrical contractors, has recently equipped the winter residence of Mr. George Taylor, in New York City, and also his summer residence on Long Island. The Jenney Construction Company, Havemeyer Building, New York, is doing a prosperous business in this cable. Among its recent installations may be mentioned the winter and summer residences of Mr. A. A. Cowles, president of the Ansonia Brass & Copper Company. Among the various installations by the Gamewell Auxiliary Fire Alarm Company, the Dundee Chemical Works, Passaic, N. J., and the Jessup & Moore Paper Mills, Wilmington, Del., may be cited.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 30, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

625,763. GROUND DETECTOR; E. M. Hewlett, Schenectady, N. Y. App. filed Dec. 1898. This is an adaptation of a well-known form of electrostatic a polyphase system, a polyphase resistance is connected across the lines and a polyphase system ,a polyphase resistance is connected across the lines and one or more of the said measuring instruments connected between ground and points in the resistance.

625,786. ELECTRIC LIGHTING DEVICE; S. E. Mosher, Chillicothe, Ohio. App. filed Feb. 28, 1898. A device for lighting the gas in incandescent burners. It consists of a pair of curved arms arranged near the top of the chimney and independently movable for the purpose of making and breaking a circuit between them to create an igniting spark.

625,787. ELECTRIC LIGHTING DEVICE; S. E. Mosher, Chillicothe, Ohio. A modification of the preceding, consisting of two longitudinally movable and oscillating arms.

625,788. ELECTRIC LIGHTING DEVICE; S. E. Mosher, Chilicothe, Ohio. App. filed May 2, 1898. Another modification of the preceding inventions of the same party.

625,796. ELECTRIC RAILWAY SYSTEM; B. E. Osborn, Auburn, N. Y. App. filed April 12, 1898. Switch boxes in the roadway are arranged with switch stands above them, containing mechanical devices operated by the vehicle for throwing the switch to deliver current to the car and cut it off from the same.

625,797. TELEPHONE SWITCHBOARD; J. M. Overshiner, Elwood, Ind. App. filed March 1, 1899. The object is to provide for automatically restoring the drop only when the plug is withdrawn from the jack socket; the invention embodies a drop having an independently movable part and a plug constructed to enter the jack and to engage the movable part on the drop so as to restore the latter only when the plug is withdrawn.

625,802. RAILWAY MOTOR; E. B. Priest, Schenectady, N. Y. App. filed Jan. 8, 1898. This is a plan for mounting the field magnet of that type of motor whose armature is mounted directly on the axle whereby the field magnet will be free to move independently of the truck frame. The supports for the field magnet extend over the truck wheels and terminate in seats which rest on the journal boxes of the truck.

625,806. OPERATING DYNAMO-ELECTRIC MACHINES; Edwin W. Rice, Jr., of Schenectady. App. filed March 1, 1897. (See Current News and Notes.)

625,816. SYSTEM OF ELECTRICAL DISTRIBUTION; Elihu Thomson, of Swampscott, Mass. App. filed May 30, 1899.

625,823. TELEGRAPHY BY MEANS OF ELECTRIC LIGHT; Karl Zickler, of Brunn, Austria-Hungary. App. filed June 24, 1898. (See Current News and Notes.)

625,826. DEVICE FOR IMPARTING END PLAY TO SHAFTS; H. W. Buck, Schenectady, N. Y. App. filed March 21, 1898. The device consists of an electromagnet of horse-shoe shape, and a correspondingly shaped armature attached to the end of the shaft. As the shaft rotates the magnetic circuit of the armature and magnet is varied. When the armature and field magnet are in line a strong pull will be imparted to the shaft, which will weaken as they are thrown out of line.

625,828. CABLE COUPLING; J. E. Case, Schenectady. App. filed March 21, 1898. For coupling cables between cars one of the terminals is fixed while the other is at the movable end of a cable. When the members are together they will remain locked as long as they occupy an angular position with respect to each other, due to the sag cable, but as soon as they are thrown into the same plane with each other, by the stretching of the cable, they readily separate.

625,830. INSPECTORS INDICATING WATTMETER; F. P. Cox, Lynn, Mass. App. filed Feb. 18, 1899. The object is to provide a portable indicating wattmeter capable of measuring the energy consumed by any lamp having a base of either the Edison, Thomson-Houston or Westinghouse types, and the invention consists of the construction of the sockets for receiving the lamps.

625,843. ELECTRIC HEAT ALARM. H. J. Jones, Wilson, N. J. App. filed July 29, 1898. To the face of a dial thermometer a glass disk is secured upon the edges of which are adjustably fixed two metallic clips forming terminals of the circuit, the index of the instrument forming the other terminal.

625,875. ELECTRICALLY CONTROLLED AND OPERATED RAILWAY SIGNAL; W. Daves, Jersey City, N. J. App. filed Dec. 12, 1898. The inventor uses an electrically operated and controlled time circuit mechanism to make and break a motor circuit and to keep the motor circuit open at all times except for a short time, while the signal is moved by the operation of the motor from one position to another.

625,903. UNCHANGEABLE INCANDESCENT LAMP; A. Schirner, Berlin, Germany. App. filed Dec. 29, 1897. In the main circuit are placed a plurality of sockets of different forms, unadapted to receive the normal form of lamp base corresponding to the socket. This insures the use of a definite kind or character of lamp at the points of consumption, the lamps having modified bases to adapt them to the different sockets.

625,915. CONTROLLER; Rt. Von Sweighbergek, Cleveland, Ohio. App. filed Feb. 27, 1899. The invention consists in part of a governing switch and a reversing switch, the former being organized to govern a motor in the power circuit and the latter to reverse such motor, and the two together to control the motor in the brake circuit by respectively governing and connecting it.

625,917. FLEXIBLE SUPPORT OR BRACKET; W. S. Arnold, San Francisco, Cal. App. filed Dec. 22, 1898. A modification of the well-known coiled wire bracket in which are provided an inner hollow core, an outer coiled metallic covering and a series of parallel strengthening wires arranged between the core and covering, said wires being rigidly connected at one end to the outer coil, but free at the opposite end whereby the same may yield longitudinally as the bracket is turned or bent.

625,921. ROTARY CIRCUIT BRAKE; H. Boas, Berlin, Germany. App. filed Oct. 20, 1898. A vessel containing mercury and an insulating fluid superposed upon the mercury, conducting segments immersed in the insulation fluid and a centrifugal device dipping into the mercury and raising the same to eject it in a stream against the conducting segments.

625,923. MAGNETO BELL STRIKER; H. Bruckner, Boston, Mass. App. filed Oct. 21, 1898. The armature carrying the striker is pivotally connected with a yoke of non-magnetic material which is secured to the magnet cores and extends from one to the other. Thus the armature cannot fail to retain the proper position with relation to the cores.

625,938. ACCUMULATOR PLATE; Harvey G. Osburn, of Chicago. App. filed July 27, 1897. A thin sheet of rolled lead has incisions or openings therein in such positions that sections of the plate may be bent or twisted into transverse positions, preferably perpendicular to the plane of the plate, to form side walls or pockets for the reception of the active material.

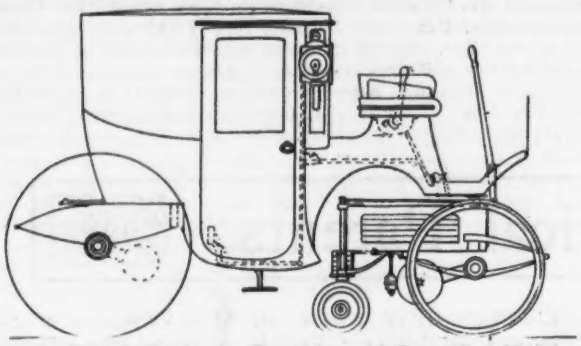
625,953. ELECTRIC DEVICE FOR PROPELLING AND CONTROLLING VEHICLES; R. M. Hunter, Philadelphia, Pa. App. filed March 21, 1899. This invention provides for converting an ordinary horse propelled vehicle into an electrically propelled vehicle without material modification in the horse vehicle. It contemplates removing the front pair of wheels and substituting another pair by making the usual king bolt connection, the substituted set of wheels carrying a box containing a battery and also the propelling motors.

626,002. APPARATUS FOR FIRING ORDNANCE ON SHIPS; M. J. Cueadros, Lima, Peru. App. filed April 19, 1898. Means are provided for mounting a pendulum to be held in proper relation to a contact pin for engagement therewith to close an electric circuit when the ship is in its normal position, so that correct firing of guns may be accomplished.

626,009. TRANSMITTING MOVEMENT TO A DISTANCE BY AN ELECTROMAGNET MECHANISM; E. Raverot and P. Belly, Paris, France. App. filed June 27, 1898. This device, applicable for steering purposes, is an electromagnetic mechanism working with continuous currents of various strength and with a compound magnetic field. The inventors employ two concentric terminals of equal radii and of opposite polarity, an odd number of equidistant brushes in contact with said terminals, and means for relatively varying the position of the brushes and the terminals.

626,017. INCANDESCENT ELECTRIC LAMP; R. W. Carroll, Blachinsville, Ill. App. filed July 1, 1898. A multiple filament lamp with a special form of socket for throwing one or more of the filament into circuit.

626,020. MECHANISM FOR STARTING, STOPPING AND REVERSING DIRECTION OF MOTION OF ELECTRIC MOTORS AND FOR CONTROLLING SPEED OF SAME; J. H. Foster, New York, N. Y. App. filed July 8, 1898. It frequently happens that when a number of motors with their accompanying controllers and switches are brought together for use in synchronism, as on a train of electrically propelled cars, the reversing switches of some of the motors will be so adjusted as to cause the current to pass through their respective motors in directions different from the

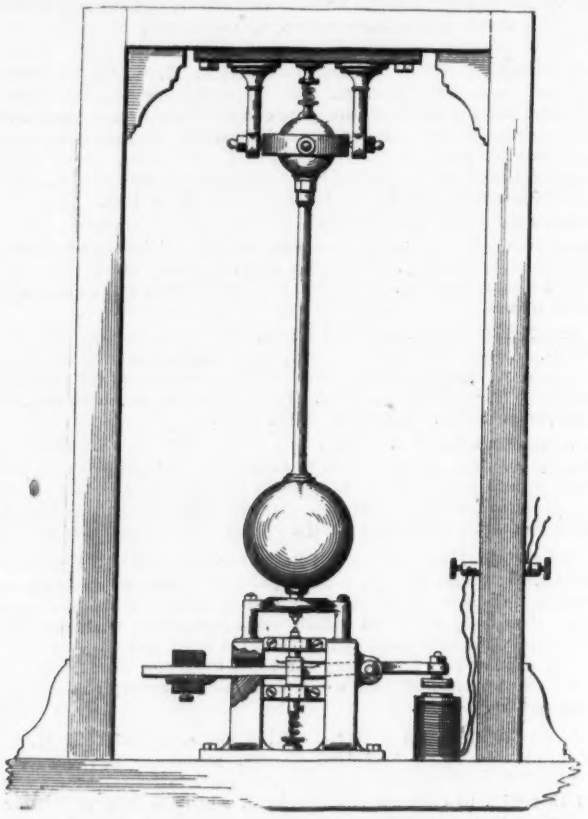


625,953.—Electric Device for Propelling and Controlling Vehicles.

current in the other motors. This invention consists, first, in means whereby the several switches are all operated in unison to cause the delivery of current to their respective motors in the proper direction; second, in means whereby the reversing switches are made to reverse the currents to their respective motors and the direction in which said switches are moved indicated to the motor man; third, means whereby the movements of the current controllers are arrested at one point in their rotation and then moved rapidly forward over another portion thereof.

626,046. COMPOUND FOR BATTERY SOLUTIONS; H. Blumenberg, Jr., New York, N. Y. App. filed Feb. 10, 1899. The solution consists of a sulphate of aluminum, bisulphate of the metals of the alkalies or alkaline earths and a chlorate of the metals of the alkalies or alkaline earths. The inventor finds that the action of the solution is more regular and progressive and that no porous cup is required.

626,065. INSULATOR; W. E. Holmes, Newton, Mass. App. filed Feb. 16, 1899. This invention provides a lamp secured to the limb of a tree to move



626,002.—Apparatus for Firing Ordnance on Ships.

therewith when tossed or swayed by the wind, it is formed for attachment to a wire already strung and which has provisions for permitting the wire to move relatively thereto without injury to the wire or to its insulating covering.

626,111. TELEPHONE CONNECTING CIRCUIT; G. H. Thompson, Malden, and T. C. Wales, Newton, Mass. App. filed Aug. 6, 1898. The mechanism is set forth in the following claim: In a telephone signaling circuit, in combination, a trunk circuit having a repeating coil with four windings which are normally in series in pairs with the conductors of the circuit respectively, an electromagnetic switching device and a normally disconnected battery; a cord-circuit having a battery in a bridge; with a substation circuit, whereby when the trunk circuit is interposed between and connected with the cord circuit and substation circuit; current from the cord circuit battery circulates through the circuit thus organized, and when the telephone at the substation is removed the said electromagnetic device operates to switch the coil windings in the opposite conductors into series with each other and in bridges between said conductors and include the disconnected battery in circuit with the substation side and establish two inductive circuits each with a separate battery.

626,131. SELECTIVE ELECTRIC SIGNAL; J. A. Barrett, Summit, N. J. App. filed July 28, 1898. An electromagnetic appliance consisting of two iron cores permanently magnetized with like polarity and magnetizing helices or windings surrounding the said cores respectively; a permanently magnetized armature common to the poles of both of the said cores, the said armature being normally attracted to the said poles and adapted to be repelled therefrom only when such currents are caused to pass through the windings of both cores as to reverse the polarity of the poles of both simultaneously.

626,132. SELECTIVE PRIVACY SWITCH FOR MULTIPLE STATION LINES; J. A. Barret, Summit N. J. App. filed July 28, 1898. It is proposed to use a privacy device at each station determining the operative condition of the telephone, the actuating magnet of said device being connected with the live conductors and the privacy devices at all of the stations being organized to act simultaneously to render all telephones operative or inoperative, the circuit connections of the different privacy devices being arranged in diverse combinations. In connection with such devices the central office is provided with means for producing in the line specialized currents adapted to actuate any corresponding privacy devices through the agency of said circuit combinations.

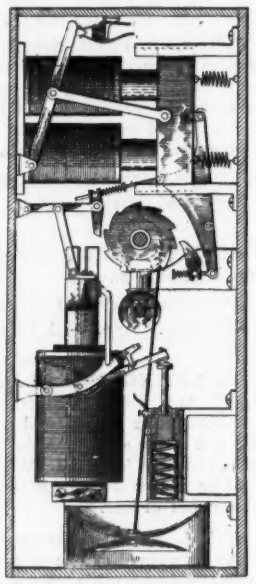
626,135. ELECTROLYTIC METER; E. O. Balastian, London, Eng. App. filed Sept. 26, 1898. In the vessel containing the electrolyte is an open frame of insulating material having thin sheets of platinum mounted upon its opposite sides and held out of contact; these platinum sheets constitute the electrodes of the meter.

626,143. INSULATED JOINT FOR ELECTRIC FIXTURES; E. E. Clift, Philadelphia, Pa. App. filed Feb. 8, 1899. Minor structural features tending to promote the insulating and supporting qualities of the joint.

626,146. TELEPHONE TOLL CIRCUIT; H. M. Crane, Boston, Mass., and T. C. Wales, Newton, Mass. App. filed May 25, 1898. The invention relates to toll trunking circuits which extend between operators in the same central station or between two central stations, whereby the substation circuits associated with the stations may be placed in connection with each other. The object is to render it at all times possible for a calling subscriber to signal an operator in case he fails to obtain desired connections, this not being possible according to previous practice.

626,168. TROLLEY CATCHER; F. N. Kelsey, New Haven, Conn. App. filed Dec. 14, 1898. A spring actuated drum over which the trolley rope is wound, is provided with locking devices which prevent the unwinding of the drum in case the trolley pole flies upward suddenly, but permits it to unwind if the motion of the pole is only at normal speed.

626,172. ROTARY TRANSFORMER OR SYNCHRONOUS MOTOR; Benjamin G. Laurence, of Pittsburg, Pa. App. filed July 24, 1897. (See Current News and Notes.)



626,020.—Mechanism for Starting, Stopping and Reversing Direction of Motion of Electric Motors and for Controlling Speed of Same.

626,178. METHOD OF AND MEANS FOR REGULATING ELECTRIC MOTORS; Robert Lundell, of New York, N. Y. App. filed March 3, 1899. (See Current News and Notes.)

626,190. ELECTRIC ARC LAMP; F. R. Pepin, Chicago, Ill. App. filed Oct. 28, 1898. Details relating to the structure of the feeding devices.

626,209. ELECTRIC FAN; E. B. Nichols and C. A. Erden, Philadelphia, Pa. App. filed Feb. 11, 1899. This is a hand fan, the guard and motor frame having a handle by which the whole machine may be carried around; the handle contains a switch.